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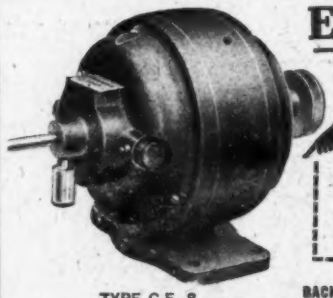

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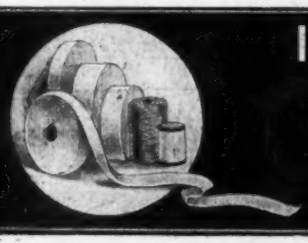

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## THE NECESSITY FOR SCIENTIFIC COSTING.

COST accountancy is a subject which, ten years ago, was practically unknown to the general public and by no means so well known as it should have been in industrial circles. For many years cost and works accountants exercised their functions in obscure corners of large industrial concerns, and their aims, aspirations, and achievements were rarely understood or appreciated by the busy world around them. With the advent of the war, however, came the urgent need for securing from all available sources the maximum output of war material at a minimum of cost. Business men recognised the necessity for scientific costing as a means to an end, and the application of approved costing methods to production on a national scale enabled the Government to obtain adequate supplies for carrying on the war. Accordingly, scientific costing was welcomed as a new discovery, but the chaotic conditions following the war had the effect, perhaps, of retarding its progress temporarily. There came a time, however, when business men realised that the artificial prosperity which existed was leading the country to ruin, and with that realisation came an even greater need for the most stringent economy, which could only be brought about by the practical application of scientific costing methods. Some three years ago the Institute of Cost and Works Accountants was formed, with a view to bringing about proper organisation of the cost and works accountancy profession, and in that there is no doubt that it has succeeded. It has held a great number of meetings, both in London and in the provinces, at which the various aspects of costing have been discussed, and the fact that some of our most eminent industrialists have attended these meetings is evidence of the esteem in which the body is held.

On February 3rd a conference was held at the Holborn Restaurant, London, when scientific costing was discussed, the chair being occupied by Lord Weir of Eastwood, whilst Mr. H. Mensforth, Director-General of Government Factories, also delivered an interesting address. After attending that conference, one could not but be struck by the immense possibilities which are open to the efficient cost accountant. The chief aims of a costing scheme are the determination of true cost, the provision of a reliable basis for estimates; control of stocks and work in progress; valuation of work in progress and semi-finished products; and provision of statistical information for the guidance of the management. This last covers a very wide and valuable field, and includes periodical comparisons of costs, by which items of undue expenditure can be located, comparative costs of different methods, determination of future manufacturing policy, and general statistics. As one speaker

at the conference aptly defined him, the cost accountant must be the index finger, to point out items of cost which are unduly high, in order to enable the management of a factory to apply the axe, an instrument with which we are all extremely familiar of late, although not with the application of it in high places. The cost accountant can only diagnose a complaint; he cannot medicate it.

Although cost accountancy cannot be regarded as in its infancy, there are still many matters which will have to be very thoroughly investigated before the fullest use can be got out of it. For instance, standardisation is a subject which is occupying the attention of many people, both inside and outside the profession, at the moment. It goes without saying, of course, that in the adoption of a costing system regard must be had to the conditions, the output, and the nature of the articles produced in a given factory. Every manufacturer looks upon his particular business as one possessing peculiarities; this is correct to an extent, but there should be no difficulty in standardisation, at least, so far as particular industries are concerned. In some industries it is necessary to standardise in order to secure uniformity of prices amongst thousands of businesses, many of which are comparatively small. Other industries, producing lines which can be specified exactly, may fix selling prices in committee for the whole trade, and standardisation for such an industry should proceed along the lines of definition of terms, classification of expenses, application of agreed principles, and the adoption of uniform methods. Whatever scheme is adopted by any particular industry, however, it must be adaptable and flexible. It has been suggested that schemes should be evolved by the masters' federations of particular industries, for use in those industries, and in at least one industry such a scheme has been evolved, and adopted by many, with a good deal of success.

Considerable difficulty has been experienced in connection with the correct allocation of on-costs, or overhead charges. Many and varied are the methods adopted. Labour costs and costs of materials in the production of an article are more or less easy to arrive at, but the amount which has to be added in respect of rent, rates, taxes, floor space occupied, &c., is a matter on which widely divergent views exist, and here, again, the peculiar conditions of particular industries, and factories, play an all-important part. The matter, however, is exercising the minds of members of the Institute of Cost and Works Accountants, and although it might perhaps be folly to expect any considerable degree of standardisation in this respect, yet rules of some sort for the guidance of cost accountants are necessary.

From the point of view of the management of a factory, however, as was pointed out by Lord Weir, it is necessary to avoid the tendency for cost accountancy to become unduly academic in its spirit and in its practice. A busy manufacturer must have his figures presented to him in a manner in which they can be properly assimilated. What is perhaps simple to a trained accountant, familiar as he is with figures, is not necessarily understandable by a man at the head of a business, who merely wants to find out quickly what his expenses are, in order that he may decrease them if they are unduly high. Again, much has to be done in the direction of educating both the workman and the employer into the value and the meaning of a costing system. If a workman can be made to understand that production on the most economical lines is going to affect his wages, then we may look forward to a greater degree of co-operation than exists at present. The conservatism of the employer can also be overcome by education. In this connection it is interesting to call attention to allegations made last week, before a committee under the Safeguarding of Industries Act, that British manufacturers of aluminium hollow-ware do not cost their products efficiently, whereas on the Continent manufacturers are very thorough in their costing methods. One witness said that he had visited factories in this country, and had never seen an efficient costing department. It should be pointed out that the allegations came from importers of foreign goods, but it is obvious, from the speeches made at the conference, that those allegations are not strictly in accordance with fact. There are some, of course, who are not paying sufficient attention to the thorough costing of the articles they produce, but such a sweeping statement as that made by the importers in question surely cannot be justified. A very good answer is that British manufacturers are not likely to take a gentleman, known to be an importer, into their confidence as regards their costing methods. The Institute of Cost and Works Accountants has a long and arduous task before it. It is making every effort to raise the status of the cost and works accountant, and as an indication of the very high standard of merit demanded by the Council from candidates for admission, the records show that about 60 per cent. of the applications received since its incorporation have been rejected.

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**The Wimbledon Case.**

A VERY unfortunate corollary to the dispute between the E.P.E.A. and the Wimbledon Council was the appearance in the week-end Press of a statement that if the E.P.E.A. did not get what it wanted by peaceful means, there was still a way open to get it by withdrawing its members in London, or possibly all over the country. That the E.P.E.A. Executive had no hand in the publication of such a pseudo-threat is authoritatively stated, and this might almost have been assumed, for the E.P.E.A. itself would suffer from such an announcement, and whoever started the rumour has done the Association a very ill service. A strike threat can only be defended as a last resource when absolutely vital issues are at stake, and when there is no possibility of settling the dispute by peaceful means, and even then it can only be legitimately directed against the people concerned. We accept the Association's repudiation of the alleged threat the more readily seeing that it is a cardinal feature of the policy of the Executive to exhaust all possible means of negotiation and arbitration before resorting to extreme measures; as we stated in our last issue, the Association took up the matter with the Ministry of Labour with a view to the initiation of an official inquiry, but its efforts appear to have been unsuccessful; on the other hand, it is reported that an attempt is being made to have a "town's meeting" called to discuss the action of the Council.

From the report of the meeting of the Wimbledon Borough Council on January 31st in the *Wimbledon Borough News*, we learn that the decision to dismiss Mr. Lee was carried by sixteen votes to six; the members of the minority for three hours "did their utmost to extract from the committee their reasons for this drastic action, and implored the Council to at least give Mr. Lee a chance of defending himself, but their efforts were met all along the line with stony silence." Councillor Foster, who had spent the last year on the Electricity Committee, declared that that Committee did all that was humanly possible "to make Mr. Lee's life a 'hell.' . . . . In his opinion the whole business was an expression of personal spleen and bias." Councillor Bellingham said "a grave injustice was going to be perpetrated on an official who had served the town for 22 years." Endeavours were made to have a committee of inquiry appointed, but without avail; every amendment was voted down by a mechanical majority.

Without prejudging the matter, we cannot think that this is a satisfactory method of dealing with the question, which is of supreme importance to one of the leading officials of the town. We sympathise with the councillors who did their utmost to secure for Mr. Lee an opportunity to know and meet the charges made against him, the most elementary claim of British justice. Mr. Lee himself has asked for an inquiry, and in the best interests of pure and wholesome municipal government the facts ought to be made public.

**Moving Platforms.**

Elsewhere in this issue we give some particulars of a competition opened by the City of Paris for the best design of a moving platform for use in subways, for the transport of passengers. Such platforms were first devised by a French engineer named Hénard, and it was proposed that one should be installed at the Paris Exhibition of 1889, but the first realisation of the idea was at the Chicago Exhibition of 1893 by Messrs. Gilsbee and Schmidt, who used two platforms, moving respectively at four and eight kilometres per hour.

For the benefit of readers who are not acquainted with the system, we may say in brief that the platform consists of a series of flat sections some 10 ft. in length, mounted on a continuous rail which passes over stationary wheels; the latter are kept in rotation by electric motors, thus propelling the platform, the sections of which are connected end to end throughout the whole route, which necessarily forms a closed circuit. One can step off the station platform on to a platform moving at five km. per hour, and from this on to a second platform running at ten km., and so on; and it is possible to install short local platforms at the stations running at five and ten km., which enable passengers to board the main platform running at fifteen km. per hour (about 9½ m.p.h.). A "rolling platform" was used at the Berlin Exhibition of 1896, but the largest and longest example was that at the Paris Exhibition of 1900, covering a distance of 3,500 metres, with twelve stations*. The last had two paths moving respectively at four and eight km. per hour, and was exceedingly well patronised.

Mr. W. Yorath Lewis proposed that a similar system should be adopted for the London underground railways, and developed his scheme to an advanced stage of detail; he read papers on the subject before engineering societies some years before the war.

Whilst such devices are of proved value at exhibitions, we doubt very much whether they could be made suitable for continuous use on a large scale. Numerous objections at once come to mind, not least of which is the system of boarding a platform which never stops; the provision of seats presents a difficulty, the whole length of the tunnel would have to be brightly illuminated, a hitch at any point stops the whole circuit—and so on. Nevertheless, the engineers advising the Prefecture of the Seine are apparently giving serious consideration to the subject, and it will be interesting to see what is the outcome of the competition.

---

**The "Brighton" Contract.**

The news that the first contract for the further electrification of the London, Brighton & South Coast Railway has been placed with the General Electric Co., Ltd., is of more than ordinary interest, for several reasons. It will be remembered that when the Railway Company decided to adopt single-phase traction, using motors of the La Cour or Winter-Eichberg type, it was found necessary to procure the motors from Germany, although the rest of the plant was of British manufacture. We have from time to time urged that it is of the first importance that despite the fact that the tendency in this country is towards the use of direct current, our manufacturers should equip themselves to deal with single-phase traction, which is so extensively favoured abroad, and we are exceedingly pleased to know that this important example of alternating-current operation has been placed in the hands of a British company. Details of the extent and scope of the contract have not yet been disclosed, but we believe it applies mainly to the equipment of the rolling stock.

Another interesting feature of the event is that when, some 20 odd years ago, the General Electric Co. decided to extend its manufacturing operations into the field of heavy electrical engineering, its entry was made by way of alternating-current plant; it is the company's claim that it carried out the first large installation on the three-phase system in this country, and now it has the satisfaction of making its debut in connection with railway electrification by securing the first home contract for a.c. main-line equipment. And lastly, the placing of the contract further strengthens the opinion that our industries have passed through the worst of the "slump" and are steadily getting into motion on the up grade. Although the G.E. Co.'s extensive engineering works at Witton, of which we shall have more to say next week, have been far from idle during recent months, there is ample scope for a largely increased output and for the employment of many more men. This will be a boon to Birmingham, which has suffered more severely than many other towns during the period of trade depression.

In tendering our congratulations to the company, we may add that this is the third of the important railway contracts that have recently been placed in this country. There are still many other big projects in the air, and we hope that a large proportion of the employment which they represent will be secured to British workmen.

*Electrical Review, April 28th, 1900, p. 685.

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**The D.O.T.**

Discussions have been overheard in certain commercial circles regarding the possibility of placing the Department of Overseas Trade on a direct revenue-earning basis by making a charge for the information which it supplies. One would have thought that the impracticability of this suggestion had been amply demonstrated on the former occasions when it was brought forward. The information collected and disseminated by the Overseas Trade Department is already paid for by business men through the taxes. The service is maintained at the expense of all, and should be kept open for the use of all, which would not be the case if a charge were made to those who availed themselves of it. It would not be found feasible to run the Department on the lines of an association existing for the benefit solely of its subscribers. If then it were proposed to make it self-supporting on the piece-work system, who would gauge the money value of any particular investigation or piece of information? Such a system would introduce a very disturbing element into a service which has always been unequalled for its strict impartiality and integrity.

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**Power Station Statistics.**

Some extremely interesting figures have reached us from the Electricity Commissioners, too late for inclusion in this issue; they are based upon returns received from 501 electricity works in Great Britain during the year ended March 31st, 1921, and show that the average coal consumption per kWh generated was 3.32 lb., the lowest being 1.70 lb. recorded by a station situated in "Area No. 13 (South-West Counties)." Area No. 1 (Northumberland) was a good second with 1.78 lb., and took the first place for thermal efficiency, the value of which was 17.75 per cent., whilst Area No. 13 came next with 15.50. The average for all stations in Area No. 1 was 2.08 lb. (the best area average), the worst average being that of Area No. 6 (North Wales), with 5.52 lb.

The total output of the 501 stations was over 5,167 million kWh generated, of which 212 million kWh was produced from other sources than coal and coke; of the latter fuels 7,356,757 tons was consumed.

The highest thermal efficiency of any station in Area No. 17 (Edinburgh and District) was only 7.56 per cent., and three other areas did not attain to 10 per cent. This is a poor showing: Nine out of 20 areas were over 12 per cent.

The urgent necessity of improvement in our methods of generating electricity is only too evident when we consider that, over large areas, half a stone of coal is wasted for every pound that is usefully employed.

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# A MANCHESTER OVERHEAD DISTRIBUTION SCHEME.

## THE BLACKLEY HOUSING ESTATE.

At the inquiry that was recently held by the Electricity Commissioners in connection with the South-East Lancashire Electricity District, Mr. S. L. Pearce, C.B.E., city electrical engineer and manager to the Manchester Corporation, expressed the view that it was essential that all the main transmission lines should be underground, because in the cases cited it would be a physical impossibility to provide an uninterrupted run of overhead lines, and that a line that ran partly overhead and partly underground would probably be condemned by all engineers. That Mr. Pearce is, however, willing to adopt overhead lines where the conditions are favourable will be gathered from the following details of the recently completed distribution system that has been installed to serve the Blackley housing estate, which are especially interesting inasmuch as first-class overhead distribution systems are by no means numerous in this country.

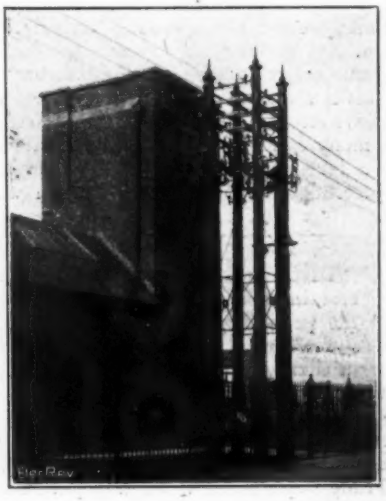

Fig. 1.—Sub-station and Four-pole Structure.

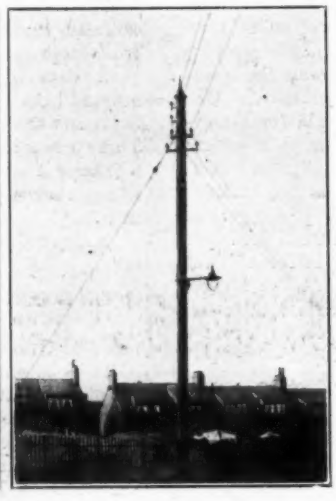

Fig. 2.—A Typical Intermediate Pole.

The system of supply is an alternating-current, three-phase, four-wire one at pressures of 420 volts between the phases and 240 volts between one phase and the neutral wire. A switch wire has been provided for the central control of the street lanterns. The whole of the work was carried out by Messrs. Twiss Electric Transmission, Ltd., for the Manchester City Corporation, by whose courtesy we are enabled to reproduce the accompanying illustrations, which convey a good general idea of the equipment installed.

We are also indebted to Mr. S. L. Pearce for permission to publish his opinion of the quality of the work and the manner in which it was carried out. In a communication to Messrs. T. E. T., Ltd., he says:—"I am glad to have the opportunity of saying that we are in every way quite satisfied with the manner in which you have carried through the contract for the distribution system of the above housing estate.

"In my opinion it constitutes a first-class example of what an overhead distribution system should be. The design of the work and the execution of the details thereof are exceedingly good.

"With regard to the poles, I think I can say they are certainly the finest that I have ever seen"—an uncommon, but well deserved, tribute to a soundly planned and carefully executed engineering work.

Contrary to the impression that a first sight might convey, the poles used are wooden ones, which were creosoted by the Ruping process. The building seen in the first illustration is the sub-station that supplies the whole of the estate. The four-pole structure was built up of 34-ft. extra stout poles, and carries the three-phase conductors, each of which consists of 37/12 s.w.g. bare copper wire; two switch wires and a split neutral are also provided. Each set of protective apparatus fitted for the phase, switch and neutral lines comprises a disconnecting link, choke coil, and lightning arrester—the whole of which gear was manufactured by Messrs. T. E. T., Ltd.

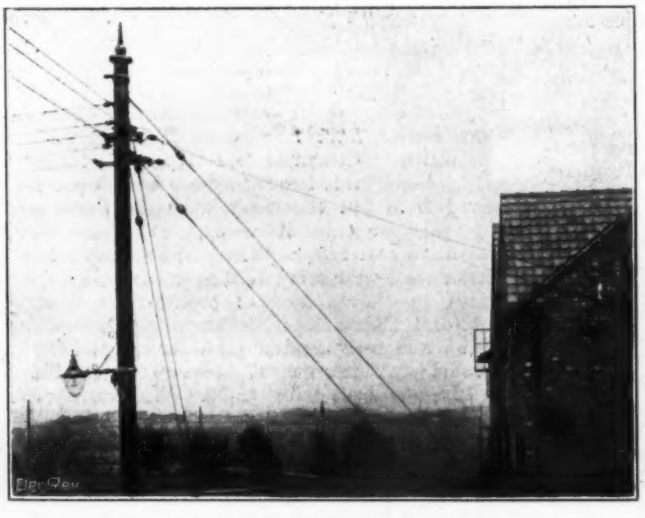

Fig. 3.—An Angle Pole and Service Bracket.

Fig. 4.—A Four-pole Structure at Road Crossing.

Fig. 2 shows the typical construction of the 34-ft. stout poles that are used at intermediate positions; each pole is stayed by means of one insulated wire, and carries a lamp bracket for street lighting purposes. Fig. 3 shows an angle pole, the conductors which it supports being all strained off. The service bracket that is seen

attached to the wall of the house on the right of the illustration is of a special design, and is arranged so that the leading-in tube also provides a means of fixing the bracket (this fitting was described and illustrated on p. 498 of our issue of October 14th, 1921). The service conductor that is connected to the phase wire is insulated with "p.b.j.," and is located above the bare copper conductor connected to the split neutral; the service wires are of No. 10 hard-drawn copper wire.

Some idea of the extent of the area served by the installation is conveyed by the fact that three ring mains have been installed. The fifth illustration shows a three-phase distributing main, with a split neutral and switch wires, that forms a portion of one of the ring mains, and the strain insulators that are attached to the channel arms of the pole in the foreground have been provided to accommodate service conductors when the latter are required.

A close-up view of the four-pole structure that is to be seen on the left of fig. 5 is given in fig. 4; it is built up of 34-ft. extra stout poles in combination with double struts in the form of stout poles of the same length. The structure carries three-phase conductors, split neutral, and switch wires, and the protective apparatus provided is the same as that fitted to the one that carries the leading-in wires to the sub-station shown in fig. 1. Underground cables carry the energy across the road to a similar structure on the opposite side, and the laths that are seen attached to the poles are temporary only, their function being to afford protection against an excess of creosote. The structure described in the last illustration is seen again about half way along the line in fig. 6, which shows the overhead distributors along Hill Lane, Blackley.

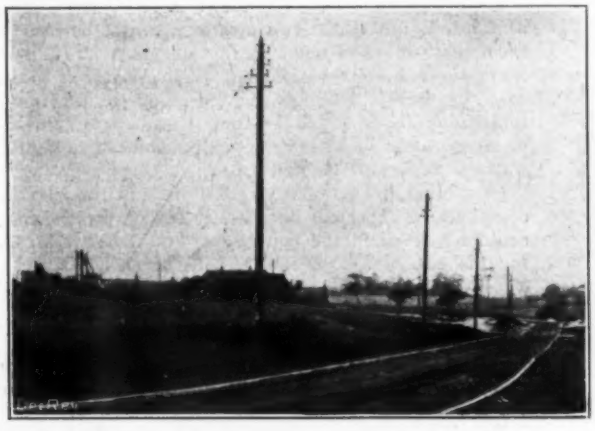

Fig. 5.—Three-phase Distributing Mains.

Fig. 6.—Hill Lane Distributors.

All the fittings and insulators used for the installation were manufactured by Messrs. T. E. T., Ltd.; pin type insulators were used at intermediate positions, and the interlinked pattern at strain points. With regard to the street lighting, the lamp brackets are provided with double-pole fuses, and are connected with Cable Manufacturers' Association 2,500-grade weather-proof vulcanised india-rubber cables, which are supported on porcelain cleats and clamped to the switch and neutral conductors.

## WORKMEN'S COMPENSATION.

By J. J. H. STANSFIELD.

The Home Office has just presented to Parliament its report giving the statistics of compensation and of proceedings under the Workmen's Compensation Act, 1906, and the Employers' Liability Act, 1880, during 1920, and these are of considerable interest.

The statistics as to compensation are derived from returns called for from employers in the seven great groups of industries—mines, quarries, railways, factories, docks, constructional work and shipping—and out of returns from 146,657 employers, 118,542 were included in the collective returns supplied by Employers' Associations, Mutual Indemnity Societies and Insurance Companies, from which it will be seen how large a proportion of employers now prefer to insure rather than cover their own risks.

The importance of the Compensation Acts will readily be seen from the fact that the number of persons coming within the Acts who are employed in these industries was no less than 8,348,150, which, although a slight decrease on 1919, probably due to trade depression, was an increase of nearly 19 per cent. on the number for 1910.

On the whole there is a tendency for the number of compensation cases to decrease, but that for 1920 shows a slight increase on the preceding year, whilst the payments for compensation are much greater, due mainly to the operation of the Workmen's Compensation (War Addition) Acts, which raised the compensation payable in cases of total disablement. This is reflected in the statement that in 1920 the average payment in case of death was £214 and in case of disablement £13 14s., corresponding with £161 and £6 7s. respectively in 1914.

In 1911 the total payments for compensation were a little over three million pounds, whilst the total for 1920 was nearly twice that sum, and whilst there are, no doubt, cases of malingering, it must be granted that the payment of such a large sum must often have relieved that anxiety due to impoverished means which at one time accompanied suffering caused by accident.

The £5,978,009 paid for compensation only represents the actual amount paid to workmen in the seven industries, or their dependents, and not the total charge on the industries. To compute this it would be necessary to take account of the administrative, medical and legal costs of employers, insurance companies, and mutual indemnity associations, including the sums placed to reserve or set aside as profits.

The figures for 1920 of the whole of the employers' liability insurance business of insurance companies are somewhat significant and worth giving in full:—

| Receipts. | | |
|---|---|---|
| Premiums ... ... ... ... ... | £8,851,607 | 98% |
| Interest on reserves ... ... ... ... | £195,952 | 2% |
| | £9,047,559 | 100% |

| Expenses, &c. | | |
|---|---|---|
| Payments under policies ... ... ... | £2,980,755 | 33% |
| Commissions and expenses of management | £2,921,959 | 32% |
| Transferred to reserves ... ... ... | £1,476,869 | 16% |
| Set aside as profits ... ... ... ... | £1,667,976 | 19% |
| | £9,047,559 | 100% |

The complaint frequently made by insurance companies in the past that workmen's compensation does not pay does not appear to be warranted to-day, and results such as these appear to a large extent to account for the steady growth of mutual indemnity associations.

Factories in which the electrical industry is principally concerned account for over 2¾ millions out of the nearly six millions paid in compensation, whilst mines, the next largest, account for almost 2¼ millions, the average charge per annum per person employed of the whole of the employés in the seven industries being 14s. 4d.; it is noteworthy that in the coal mining industry the charge works out at about 2.44d. per ton of coal raised.

The compensation period is usually of short duration; for 1920 it was 59 per cent. for less than four weeks and 93 per cent. for less than 13 weeks, though it is interesting to note that less than nine per cent. was for periods below two weeks. It is generally agreed that the provision in the Act of 1906 which entitled the injured employé to compensation from the date of leaving employment if the period of incapacity continued for upwards of a fortnight has had a tendency to lengthen the period of absence from work in the case of minor injuries.

The most satisfactory feature of the report is the steady decrease in the number of cases taken into court, the actions under the Employers' Liability Act, 1880, and appeals to Higher Courts and the House of Lords, thus showing a growing confidence in the cheaper methods of administration under the Act of 1906, this decrease in litigation being out of all proportion to the falling off in the total number of cases.

Some may still hold the view that compulsory compensation is a charge on industry which is unreasonable and a handicap to progress, but this can hardly be said to be borne out by the figures given in the report, and in any event the tendency to-day is to add to that class of social legislation which will protect the employé and provide by mutual means what in "the good old days" was considered should be met only by a policy of self-help.

## ELECTRICITY FOR THE COUNTRY DWELLER.

By J. M. C. FIELD.

As things stand at present, the day when every small town and village will be supplied with electricity from huge generating stations still seems a very long way ahead. Thousands of country houses are supplied from their own private generating plants, but it must be remembered that the high initial costs and heavy running expenses of these sets completely debar the majority of middle-class country dwellers from the use of electricity even for lighting purposes. Again, there are many people, who are in a position to afford their own generating plants, who have not the convenience to house them, or labour at hand to attend to them.

Contractors are circularising villages all over the country in the hope of picking up a few more "private plant" jobs. Could they not organise some sort of village electric lighting clubs, and thus when their men were in one village, wire up a dozen houses one after another, and put in a miniature central station to supply them all? The small automatic plant of 4 or 5 kW would be ample to supply the needs of a small village, and in almost every case a semi-skilled man could be found who would be willing to give his attention to it, and provided the houses were fairly well grouped together, the cost of overhead mains should not be excessive. Meters would be unnecessary; a small automatic circuit-breaker for each house would serve as a limiter, main switch, and main fuse at the same time.

As regards the financial side, it is suggested that the concern should not be run at a profit, but simply that each member should take his share in the initial cost and running expenses in proportion to the power he consumed. This share should be far below the cost of a private plant for each member in both items. In addition to the volunteer attendant, a secretary could be appointed, and these two members might be exempted from their share of the running expenses, in return for their services. At the end of each quarter a meeting could be held, at which the secretary would state the total amount expended in fuel, spares, &c., and each member would pay his share in proportion to the total wattage of lamps he had installed.

Of course, to get many consumers in every village could not be expected, but if only two or three members could be obtained the contractor would be well repaid for his enterprise. Minor details of such schemes are easily worked out, and a carefully-worded circular to possible clients, stating the many advantages of the scheme, should bring a much greater return than overdoing the "private plant" canvassing.

The scheme might also be enlarged upon for small town work, run on the same lines, but with a stand-by plant provided and a whole-time attendant to look after the system generally; it might even prove more economical in this case, as small semi-Diesel or suction gas engines could be used with lower fuel costs than automatic lighting sets.

The whole idea is to make electric light possible to a new class of customer altogether, such as the "new poor," village, and small town tradesman, &c., who would welcome electric light *at a moderate cost* with open arms.

## A NEW AUTOMATIC TELEPHONE EXCHANGE

A Liverpool Innovation.

At the head office of the *Liverpool Courier* and the Liverpool *Evening Express*, on January 16th, Sir William Noble, M.I.E.E., engineer-in-chief to the British Post Office, inaugurated a new automatic telephone exchange that has been installed for the use of the above-named journals, and was presented by Mr. A. Burchill, managing editor, with a souvenir piece of plate in the form of an inkstand with a "Relay" telephone dial switch in the centre. For the occasion the dial switch was connected to the installation, and Sir William made his first call by its aid. The equipment was supplied and fitted by the Relay Automatic Telephone Co., Ltd., and the new private branch exchange forms a new departure in more than one way. The new exchange, it should be explained, is the pioneer newspaper installation of its kind. Not only is every department and, indeed, every department, capable of automatically communicating with every other one, but it can also establish equally immediate automatic communication with the private manual switchboard which handles the outgoing and incoming messages between the establishment and the public Post Office exchange. That the Post Office authorities countenanced the installation of the new automatic exchange marks a further advance in the policy of its telephone department. It is believed that only one precedent exists, and that is Messrs. Siemens's works at Woolwich, where the granting of permission to connect such an exchange with the public telephone service for experimental purposes was regarded by the authorities as a very special privilege.

We understand that the new installation has already demonstrated its capacity to speed up even external communication to an appreciable degree, and so far as interdepartmental work is concerned the service is said to be "simplified expedition itself."

The new automatic exchange has been equipped to deal initially with 50 subscribers' lines, but it is capable of being extended. All the lines have access to and from one of the G.P.O. public exchanges in Liverpool through a manual board of the G.P.O. standard c.b. type, and is equipped with standard cord circuits and exchange-line circuits.

It should, perhaps, be explained that confusion concerning the difference between automatic telephones proper and inter-

communication systems should be guarded against. The latter have, of course, their use for small installations, but, generally speaking, they are limited in practice to a small number of connections, and have usually the further disadvantage of requiring more cables. The whole of the operations of the Relay automatic system, which has been fully described in our pages, on the other hand, are manipulated by means of a central automatic switchboard, to which each instrument is connected by twin wires only. The accompanying illustration, fig. 1, shows the board with all the relay covers, except three, removed. The ordinary well-known P.O. pattern of desk telephone instrument is used, to the base of which a dial switch is added.

From the point of view of modern daily journalism the advantages of an efficient system of automatic telephony are both manifest and manifold, and Sir W. Noble took the opportunity the opening ceremony offered of addressing a gathering of business men on the significance of the installation to the development of telephony in this country. Mr. A. Burchill, in asking Sir William to open the installation, remarked that their judgment in providing it was confirmed by the fact that the British Post Office was now prepared to supply any subscriber with a similar system on rental.

Sir W. Noble congratulated the *Courier* on being the newspaper pioneer in introducing the automatic system, and pointed out that private automatic exchanges were due to the enterprise of private individuals—the Post Office had no control over them. The first automatic telephone exchange operated by the Bell Co. in America was only opened for service at the end of 1921, whereas in this country the auto-

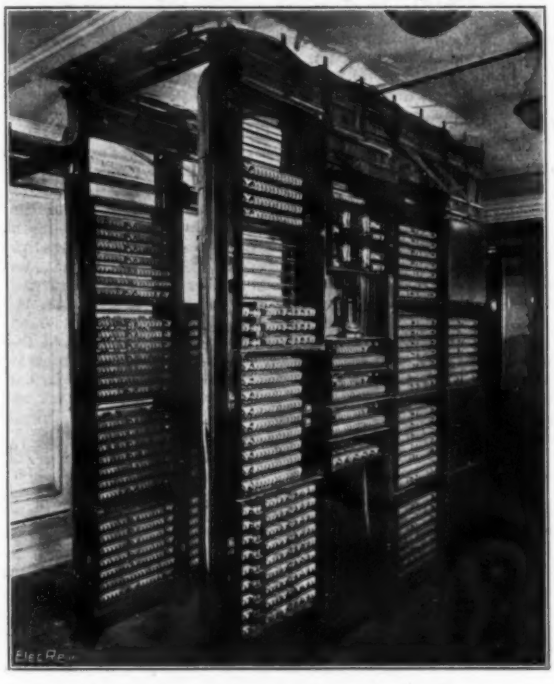

Fig 1.—Automatic Telephone Relay Rack.

matic telephone problem was tackled in 1912 with the installation of a small trial public exchange at the head office. It proved successful, and two more were opened in 1914, three in 1915, four in 1916, two in 1918, and two last year, while at present six others were under consideration. All had proved highly satisfactory, but they were all located in self-contained areas, wherein only one large exchange existed. In no part of the world had automatic exchanges yet been installed in multi-office areas—namely, areas in which there were several large or a number of small exchanges.

Between January, 1912 (the date of the transfer of the service by the National Telephone Co. to the Post Office) and the outbreak of the war the Post Office had expended over £7,000,000 upon the improvement of the service. During that period it had installed 56 new large exchanges and extended 27 existing ones by contract, whilst 137 small exchanges were installed by its own staff. Since the Armistice they had placed orders with contractors for 86 new exchanges, and for 57 extensions of existing exchanges, besides a large number of small extensions made by the Post Office staff. In local development, such as the construction of underground lines for telephones in place of the overhead system, they had since the Armistice spent over £6,000,000, and for trunk lines they had spent over £4,000,000. In Liverpool they had provided a new Central Exchange, a new exchange in Wallasey, and had also extended 30 other exchanges.

## NORTH LANCASHIRE AND SOUTH CUMBERLAND ELECTRICITY DISTRICT.

### Commissioners' Local Inquiry.

An inquiry into the scheme that has been submitted by the Provisional Joint Committee for the area in connection with the proposed constitution of a Joint Electricity Authority for, and the improvement of electricity supply in, the above-named district* was opened at Barrow-in-Furness on January 31st. The Commisioners present were Sir John Snell (presiding) and Mr. H. Booth, who were assisted by Mr. D. S. Cumberledge, and counsel included Mr. W. S. Kennedy (for the Joint Committee), Mr. Edward Wooll (for the Barrow Corporation), Mr. Jacques Abady (for the Millom urban, Bootle rural district, Whitehaven town, Whitehaven rural, Egremont, Cleator Moor, and Arlecdon and Frizington urban district councils), Mr. Alfred Tylor (London North-Western, Midland, and Furness Railway Companies), Mr. Wm. Proctor (Kendal Corporation), Dr. T. Eastham (rural district councils of Lancaster, Lunesdale, South Westmorland, and Ulverston, and the urban district councils of Windermere, Ambleside, and Grasmere), and Mr. S. H. Smith (Windermere District Electricity Supply Co., Ltd.).

Objections to the scheme, or to inclusion in it, had been lodged by 20 of the local authorities, and there was a large attendance.

Sir John Snell (chairman), in opening the inquiry, referred to the peculiar position in which they found themselves. Local authorities and interested parties had appointed representatives to form a committee to consider the best means of improving the electricity supply in the district; that committee had submitted a scheme. Since then, however, several of the authorities which sent representatives to the committee had passed resolutions either objecting to inclusion in the area, or objecting to the scheme, and there appeared to be a considerable amount of misunderstanding.

Mr. W. S. Kennedy placed the scheme† before the Commissioners, and pointed out that the greater number of the objections was not received until the beginning of January. He did not think the objections were such as would justify the Commissioners abandoning the scheme in its entirety. He pointed out that the fullest possible use might be made of Messrs. Vickers's new power-house at Cavendish Park, Barrow, about the use of which the Barrow Corporation had been negotiating, and said that if that power-house was ultimately transferred to the Joint Authority there would be no need to proceed with the proposed hydro-electric power station on the river Leven at Backbarrow. If the suggestions were carried out the Joint Authority would be able to produce by 1925, at an expenditure of £217,000, 20.6 million kWh at a cost of 1.142d. per kWh, as against the 1920 supply of 8.36 million kWh at an average cost of 3.023d. He referred to the complaint that the Barrow representation on the Joint Committee was too small, and detailed the financial and technical sides of the scheme.

Mr. P. J. Hibbert, J.P., Ulverston R.D.C. (chairman of the Provisional Committee), was called to support the scheme, and was closely examined by Mr. E. Wooll, who pointed out that only the previous day the Barrow Corporation had passed a resolution objecting to being included in the scheme, and recommending as a practical alternative that the Corporation be authorised to enter into a reciprocal agreement with the districts of Dalton and Ulverston for furnishing them with electricity.

Mr. P. J. Hibbert believed that Dalton and Ulverston were the only places that now supported the scheme in its entirety. Under the scheme, while Barrow would lose control of her own generating plant, the town would gain in that there would be a cheaper supply of electricity. Barrow, too, would have to face certain charges as to transmission. If an alternative area were possible, the Barrow, Ulverston, Dalton, North Lonsdale, and Millom area would be an easy one to work.

In answer to Mr. Entwistle (Town Clerk of Morecambe, who also represented Lancaster and Heysham) Mr. Hibbert said there were no chances of industrial development in the district. Replying to Mr. W. Proctor, he said Barrow having now refused to come into the scheme, it had no bulk supply source in prospect. It was proposed that Windermere should come into the scheme later. For that district special plant would be necessary. Many of the districts were of an agricultural kind, but there would be a demand for electricity if they were educated up to it. Millom had desired to be included in a Cumberland area and to use waste gas from Millom ironworks, but the Committee had not agreed to that.

Sir John Snell said the question of Millom being included in a Whitehaven and Workington area was an important one, and they would want expert evidence.

Mr. Hibbert was cross-examined by all the counsel engaged, and then Mr. R. Dilworth (chairman of the Ulverston urban council) and Mr. T. M. Kay (vice-chairman of the Dalton urban council) spoke with regard to a supply of electricity being required in their urban districts.

*Elec. Rev., December 3rd, 1920; p. 721.
†Elec. Rev., August 8th, 1921; p. 230.

Mr. H. R. Burnett (secretary to the Joint Committee and electrical engineer to the Barrow Corporation) explained that the technical details of the scheme were got out with the approval of Major Milne, engineer to the Lancaster Corporation. He submitted new tables showing the generation costs for 1921, as follows:—

Total cost of generation only at the existing stations (Barrow, Lancaster, Morecambe, Kendal)=1.794d. for 10,957,635 kWh sold=£81,936, excluding capital charges. The estimated charge for bulk supplies in the first period of the scheme to 1925=20,640,000 kWh (10,560 kW estimated maximum demand) at 1.5d., or revised in view of reduced coal and other charges since the preparation of the scheme=1.1d. per kWh sold.

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When the inquiry was resumed on February 1st, Sir John Snell intimated that owing to an attack of bronchitis he would be unable to remain in the chair, and that his fellow Commissioner (Mr. H. Booth) would preside.

Mr. H. R. Burnett, in reply to a few questions asked by Sir John Snell, said, as an engineer, he favoured the whole area being in one scheme, and if there was any question at all about that, it would be with reference to the northernmost part in the Bootle area, where the only place of any size was Seascale. He did not see any prospect of Seascale being connected up with the transmission lines, but if it was desirable a small generating station could be started there. Mr. Burnett advocated one Joint Committee for the whole area, and said it would be more efficient to have one than two areas.

Sir John Snell then vacated the chair and Mr. Burnett was closely examined upon details of the scheme by Mr. E. Wooll. He did not place too much reliance upon the last decision of the Barrow Corporation, because that might yet be varied. He did not think the scheme could go on without Barrow's co-operation.

After the adjournment Mr. Patterson (on behalf of Westmorland County Council) and Mr. Bryning (on behalf of Lancashire County Council) asked the Commissioners, if the scheme was approved, to give them direct representation upon the Joint Authority.—Mr. Kennedy submitted that the County Councils' interests were protected by the joint representation of Lancashire, Cumberland, and Westmorland, and through the rural council and other local representatives. —Mr. Burnett was then subjected by Mr. Wooll to further examination respecting the proposed Backbarrow hydro-electric station, the Joint Committee's estimated administration costs, &c.—Mr. Entwistle (representing Lancaster, Morecambe, and Heysham urban councils) sought to point out that districts which had undertakings which would be taken over by the Joint Authority were not so favourably placed with regard to costs as those which had no generating stations. He said that Morecambe ought to get its bulk supply from Lancaster, and that at Morecambe and Heysham electricity was wanted in 500 houses for domestic use.

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The inquiry was resumed on February 2nd with Mr. H. Booth presiding and Mr. Archibald Page sitting as a Commissioner in place of Sir John Snell.

Mr. H. R. Burnett was further examined by Mr. Entwistle (representing the Lancaster, Morecambe, Heysham, and Carnforth Councils) who referred to the electrification of railways, and suggested that Lancaster would want to be linked up with the London & North-Western Railway, and possibly with a contemplated new generating station at Preston.

Mr. Burnett did not think railways would be electrified in the first period of the scheme, 1925, and if he had assumed that they would be, he might have been accused of putting a fictitious demand in the scheme.

The Chairman pointed out that they were not concerned with the electrification of railways, but with the scheme affecting Lancaster town and district.

Mr. Burnett pointed out that the success of the scheme did not rest upon the industrial position at Barrow. The output at present, despite extraordinary depression in trade at Barrow, showed an increase.

Mr. Entwistle mentioned that the estimated capital expenditure for the first period of the scheme did not provide for telephone or pilot wires, and he questioned whether single transmission lines would meet the needs of the area if the scheme was approved. He next dealt with coal consumption, and submitted that Lancaster might be able to get equal results to those of Barrow.

Mr. Entwistle was referring to national developments when the Chairman interposed that there had been a great deal in the electrical Press and other papers about those schemes being national, but they were not.

Mr. Proctor (on behalf of Kendal) asked whether it was desirable to discuss a scheme which was dead if all the authorised undertakers declined to take part in it, but Mr. Burnett did not agree that it was dead.

Mr. Proctor referred to costs and Mr. Burnett agreed that some of the figures given in the scheme might have to be modified.

Mr. S. H. Smith (representing the Windermere Electricity Supply Co., Ltd.) and Dr. Eastham (representing Lunesdale, Lancaster, South Westmoreland, and Ulverston Rural District Councils) agreed to consult their clients to see whether they could accept a suggestion thrown out by Mr. Page that they might make a small contribution to the administrative expenses of the Joint Authority, so that in the future they would be kept in touch with the developments of the area without having financial responsibilities.

Mr. Abady (on behalf of the Bootle Rural District of Cumberland and Millom Urban District) submitted that the scheme would not be prejudiced by leaving his districts outside the present scheme.

Mr. Burnett was re-examined by Mr. Kennedy on several points that had been raised, and in reply to many questions by Mr. Page he reiterated his opinion that it was better to have the scheme as a whole than a divided one.

Mr. Wooll (on behalf of the Barrow Corporation) called Councillor Morton to state why Barrow opposed the scheme. Mr. Morton thought that financial assistance could be obtained from the twenty millions mentioned in Section 18 of the Electricity (Supply) Act, 1919, and the Chairman pointed out that that would have to be repaid. Mr. Morton had the impression also that the Act was only really intended to apply to industrial areas, and he objected to a Joint Authority because the area was not like that of South-East Lancashire.

Mr. Britton (city electrical engineer at Chester) was next called as an expert witness on behalf of Barrow Corporation, and the inquiry was adjourned.

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The inquiry was resumed on February 3rd before Messrs. H. Booth and A. Page.

Mr. Britton, the previous afternoon, had given his conclusions as follows: (1) That the Barrow Corporation and the urban districts of Dalton and Ulverston, and the southern part of the rural district of Ulverston, should be taken out of the scheme, and application be made to the Electricity Commissioners for a special order for the four authorities referred to in the urban and rural districts to support the Corporation of Barrow in an application to extend its area to include those authorities. (2) That Lancaster, Morecambe, Heysham, Carnforth, and part of the rural district of Lancaster might also agree to deal with these districts by a special order. (3) That the authorities in the remaining portion of the district might also endeavour to combine to investigate the possibilities of local water power with a view to development for the generating of electricity and the erection of transmission lines to convey electricity to the rural areas. (4) That the Barrow Corporation should enter into a contract with Messrs. Vickers for a bulk supply for a term of years on the basis contained in the letters from Messrs. Vickers dated January 24th and 30th, 1922. (5) The Corporation should discard the small hand-fired boilers and the 3 75-kW and two 150-kW d.c. generators installed at the electricity works and obtain additional rotary converters capable of taking full advantage of the bulk supply from Messrs. Vickers on the terms suggested in their letters.

The letters from Messrs. Vickers offered a night load at: (*a*) 0.65d. per kWh for not less than 40,000 kWh weekly. The price to vary between 0.6d. and 0.625d., according to the consumption, the former figure corresponding to 40,000 and the latter to 20,000 kWh weekly. The price to be determined for each week considered separately. (*b*) The maximum demand not to exceed 1,000 kW. (*c*) The supply to be taken between 5 p.m. and from 7 to 7.30 a.m., five nights a week. (*d*). The supply to be subject to one month's notice on either side. The firm also considered the letter of the Corporation offering a day supply to it of 70,000 kWh weekly, load about 5,000 kW, and suggesting a price of 0.75d. per kWh, which was based on coal at 24s. On January 26th the Corporation asked Messrs. Vickers if they would be prepared to give a bulk supply for 5, 7, or 10 years, and Messrs. Vickers said: "We are unable to confirm that we should be able to maintain the supply for any number of years at 0.75d. The price at which we are able to sell depends entirely on our own works' consumption and the consumption of the town." They were unable to offer a supply for a number of years.

Dr. Eastham (on behalf of the Lunesdale, Lancaster, South Westmoreland, and Ulverston Rural District Councils; and the Grasmere, Windermere, and Ambleside Urban Councils) withdrew their opposition to the scheme, and agreed to their remaining outside of it until they could derive some benefit from coming into it. They would be under no financial obligations, but if they did at any time find that they could get some benefit they could be admitted on terms to be agreed upon with the Joint Authority, or terms to be determined by the Electricity Commissioners.

The suggestion of Mr. Page had been considered, and it was suggested that Ambleside, Grasmere, and Windermere Urban Councils should have one representative jointly on the Joint Authority and contribute five guineas per year jointly towards the expenses of the authority. The Windermere Electricity Supply Co., Ltd., was also anxious to have a representative on the Joint Authority, and would contribute five guineas per year. If the area was divided, then Lancaster and Lunesdale wished to be associated with the Lancaster district, and Windermere, Grasmere, and Ambleside wished to be in the Barrow district, but the general view was that there should be one area.

MR. SMITH (on behalf of Windermere Supply Co.) confirmed this, and MR. KENNEDY (on behalf of the promoters) accepted the arrangement.

MR. BRITTON was further cross-examined, and then MR. WOOLL addressed the Commissioners on behalf of the Barrow Corporation.

MR. PROCTOR (counsel for the Kendal Corporation) called MR. HAROLD HOBSON, B.Sc., to give expert evidence to show that with the development of the Kendal generating station energy could be provided in 1925 at an average price of 7.176d. per kWh, against 8.39d. estimated in the scheme for the Joint Authority. He did not approve of a long single transmission line to Kendal, as suggested, and pointed out that considerable expense would be required to put Kendal in a position to receive the bulk supply. He thought that if public money was to be spent it could be spent to the greatest advantage in the Kendal and Windermere area itself, and not on a transmission line from Barrow.

MR. TYLOR (on behalf of the London North-Western, Midland, and Furness Railway Companies) was quite satisfied with the representation given in the scheme.

MR. ENTWISTLE addressed the Commissioners with regard to the position at Lancaster, Morecambe, and Heysham; and MAJOR MILNE (electrical engineer to the Lancaster Corporation) explained why Lancaster withdrew from the scheme, and why Lancaster would be better left to its own area rather than be joined up with Barrow, as suggested, by a single transmission line. He gave some interesting statistics relating to Lancaster by an analysis of the cost of supply, variation in the cost of coal, and comparison of the cost of local generation and purchase in bulk in 1925 and 1930. He said that in the area scheme, the requirements of Lancaster, Morecambe, and Heysham, would be transformed from 23,000 to 6,600 volts at the Lancaster Corporation electricity works, which would act as a main distributing station for that part of the district.

The price per kWh to the Lancaster Corporation at that point would be slightly lower than the price to be charged to the Morecambe Corporation as the load factor of the Lancaster supply was higher than the load factor of the Morecambe and Heysham supply. If the price per kWh charged under the area scheme for the supply to Lancaster was higher than the cost of local generation, it was more economical to provide the requirements of Morecambe and Heysham by the extension of the Lancaster electricity works. The cost of production by local generation was lower than the price to be charged under the area scheme for the Lancaster supply, namely: in 1925, with local generation, it would be 1.33d. per kWh sold and with a bulk supply 1.7d. In 1930 the figures would be 1.25d. and 1.51d. respectively with coal at 22s. 6d. per ton (since the estimates were prepared the price of coal had fallen to 22s. per ton). The above statistics were based on the requirements stated in the scheme for the constitution of a Joint Authority, that was submitted to the Electricity Commissioners by the Provincial Joint Committee for the district.

The supply could be generated at the Lancaster Corporation's station and delivered to the Morecambe Corporation at 6,600 volts, 3-phase, at the standard frequency of 50 cycles per second; Heysham would be supplied by Morecambe. The area scheme suggested that for the Lancaster, Morecambe, and Heysham area in 1925 the maximum demand would be 1,460 kW and the energy sold would amount to 1,905,000 kWh; and that in 1930 the figures would be 1,930 kW and 2,718,000 kWh respectively. The generating plant at present installed and being installed in the Lancaster Corporation electricity works consisted of two 300-kW, two 200-kW, two 925-kW, and one 100-kW sets, or a total of 1,550 kW. To meet the above requirements additional plant would have to be installed at Lancaster as follows: 1925, three water-tube boilers, &c., £12,500; two 750-kW, 6,600-volt, 3-phase, 50-cycle turbo generators, &c., £21,500; switchgear, £500; cable, &c., £500; 500-kW of converting plant, £5,000, or a total of £40,000. In 1930 a fourth boiler, &c., at a cost of £3,000, would be needed. The estimated cost of production with increased capital charges would be in 1925 1.46d., and in 1930 1.22d. per kWh sold.

MR. JACQUES ABADY (on behalf of the Millom Urban District and Bootle Rural District Councils) called witnesses to show why this portion of Cumberland should be excluded from the scheme of the Joint Committee.

MR. KENNEDY replied on behalf of the Joint Committee to points raised, and the inquiry was then closed.

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**Unprofitable Consumers.**—Speaking recently at the Manchester Rotary Club, Mr. E. O. Walker said that it was difficult to make electricity remunerative in districts where only a few lights were used for an hour or two a day, and for such consumers a charge of one shilling a unit was not too high. What was wanted was a class of customer which would take a regular supply distributed as evenly as possible over the twenty-four hours. In any case the plant had to be kept constantly running, and electricity could not be stored so effectively or inexpensively as gas. Mr. Walker mentioned some of the many advantages of electricity, and said that this country was, electrically, in its infancy as compared with America and the Continent.

## CORRESPONDENCE.

*Letters received by us* **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### An Overworked Iron.

I have read with interest the letter appearing in your issue of January 27th regarding the performance of a 100-volt electric iron which was used on a 200-volt circuit for twelve months. This result is, to say the least of it, unique, and although not wishing to doubt the good faith of your correspondent, calm consideration of some elementary facts leads one to doubt whether, after all, the iron was not incorrectly rated originally.

Presuming, however, that the article in question was an ordinary 4- or 5-lb. domestic iron, rated to consume 400 watts at 100 volts, and that it had a face area of 25 sq. in., when 200 volts were applied, the consumption would rise to 1,600 watts, or about 64 watts per sq. in., a result which all the heating and cooking appliance manufacturers of the world, aided by all the resources of modern science, have striven for and failed to achieve.

That the nichrome wire would stand up to the double voltage for a few minutes is understandable, but that it should survive regular use for a whole year is amazing, and one is tempted to inquire what the thermal efficiency of the iron would be if used on its rated voltage.

I would also submit that cheap advertisement of this description is not conducive to happy relationships between manufacturers and the trade, as it is likely to mislead the lay user of electric irons as to their adaptability to *any* circuit, no matter what voltage.

London. **Wm. B. Scourfield.**
*January 31st*, 1922.

[This letter having arrived too late for inclusion in our last issue, a copy was forwarded to the makers of the iron, whose reply is given below.—EDS. ELEC. REV.]

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As manufacturers of "Revo" electric irons, we are particularly interested in the letter over the name of Wm. B. Scourfield. In reply, we confirm that the iron in question was correctly rated, and that the testimonial referred to was an unsolicited one.

It is news to us that "all the heating and cooking appliance manufacturers of the world, aided by all the resources of modern science, have striven for and failed to achieve" a loading of "64 W per sq. in." This has not been our ambition anyway, and we are considered one of the principal electric heating appliance manufacturers in this country, our products having a world-wide reputation. Instead, we have made it our aim to produce articles that, besides doing their work satisfactorily, will withstand a reasonable amount of rough use, and in this we claim to have been successful.

In spite of your correspondent's remarks quoted above, several manufacturers have for years made and used successfully elements for 64 W per sq. in. and more.

Your correspondent is "tempted to inquire what the thermal efficiency of the iron would be"; he bases his figures on a presumed loading which is incorrect, and assumes a radiating area that is also incorrect; might we suggest that Mr. Scourfield gets his information right before rushing into print? If your correspondent had considered for a moment, he would have understood, perhaps, that an electric iron is never in use continuously; further, modern electric irons are frequently given a high loading for quick heating, so that heavy damp work can be done; consequently, when the same iron is doing light work, the current is only used for part of the time; in fact, your correspondent might have "presumed" that the current would be switched off some time before the iron became red hot, to allow ironing to be proceeded with.

Regarding the "adaptability of electric irons to *any* circuit, no matter what the voltage," we do not think it is necessary to explain in a technical journal that an electrical appliance should be used on a circuit of the correct voltage. The fact that a "Revo" iron intended for use on a 100-volt circuit was used as a 200-volt iron and withstood the "test" for a considerable time, as vouched for by an independent witness, will be satisfactory evidence to the majority of your readers, if not to Mr. Scourfield, that the appliance in question was built on substantial lines, and it is only because the iron was incorrectly used that there is anything remarkable in the incident. A manufacturer cannot always find out what treatment his products get, but when he hears of their being used in an abnormal and absurd manner and standing up to it, then even if a sense of humour is lacking, there is some satisfaction in having produced a sturdy British article.

A little time ago we received another unsolicited testimonial regarding an iron similar to the one referred to above. This had been forgotten and left on circuit all night; in the morning it was found that the iron had burnt its way through a table, carpet, and part of the floor. The iron was dropped into a bucketful of water, but after drying out, the element and insulation were perfect.

In case your correspondent has missed the point of this also, we mention that the incident shows that a modern well-

constructed iron like the "Revo" will withstand more than a little ill usage, but it is not our intention to recommend the "adaptability" of electric irons for other purposes than ironing.

In conclusion, we may say the originals of either of the testimonals referred to may be seen on application.

**P. W. Davis,** *Engineer.*
Tividale. *Cable Accessories Co., Ltd.*
*February 6th*, 1922.

### An Old Problem Revived.

Perhaps one of your readers will give me the answers to the following problems, which I have been unable to solve by reference to any text-book in my possession.

First: A permanent bar magnet, of circular cross section, is made to revolve on its longitudinal axis by mechanical means. Does its external magnetic field revolve with it, or does it remain stationary?

Second: Substitute an air-cored solenoid, through which current is passing, for the above bar magnet. Cause it to revolve on its longitudinal axis in the same way. Does its field revolve with it, or remain still?

I should be glad if someone could suggest a simple experiment by means of which it could be clearly demonstrated whether the field revolves or not.

**Loadstone.**

*February 3rd*, 1922.

### The Magnetic Screening of Cables.

I wish to thank Mr. Raymond-Barker for the copy of his booklet, which contains much interesting information.

The paragraph quoted from H.M. Stationery Office's pamphlet is written as an axiom, and I am sure Mr. Raymond-Barker will agree that as such it is incorrect.

If connections are arranged so that the tube forms a closed circuit, then with alternating current the magnetic effect of the current in the core will be neutralised by the induced current in the tube, but this is not magnetic screening in the ordinary sense. It must be remembered that the quotation in question said "current constant or variable," and no amount of earthing of the tube would cancel the magnetic effect if the current is d.c.

The other correspondent, "Screened," is a perfect example of a misled engineer, and he must blame the authors of our text books.

"Screened" says that the matter has not been dealt with in the text books, because it is obvious that the metal tube will effect magnetic screening. A lecturer at one of our colleges recently remarked that the matter had not been dealt with because it was so obvious that the metal tube would have no magnetic screening effect.

The writer still hopes that one of your readers will refer him to a text book which deals with this subject.

**Hardly Convinced.**

*February 6th*, 1922.

[The subject was dealt with by Prof. H. du Bois in the *Electrician* of March 11th, 1898, p. 652; he stated that the tube had no magnetic screening effect.—EDS. ELEC. REV.]

### A Notice to Callers.

For one not connected with the electrical industry, and only a casual reader of the REVIEW, Mr. C. J. Docherty seems to have suffered considerably upon reading the "Notice to Callers" displayed in our reception office and reproduced with comments in your issue of January 27th. Unfortunately, in his anxiety to secure relief he has chosen to indulge in an attack upon the keenness and worthiness of the buyer of this company, and has let his imagination run riot to the extent of assuming the presence of an autocratic commissionaire holding supreme sway in the outer office. May Mr. Docherty be assured that in this instance his suffering is needless and his imagination distorted?

The notice indicates that the buyer will be pleased to interview upon certain days during certain hours, with which the casual caller is immediately acquainted by reading the notice displayed. If by chance the call is within the prescribed hours an interview is secured in turn. If, however, the call is made at any other than the stipulated time the traveller knows definitely when to return. In this way the valuable time of both is saved and the buyer is free to make and keep special appointments, and so arrange these as to leave himself at liberty for the casual caller (and 'their name is legion, for they are many'), or of equal or even greater importance to fix dates for the tour and inspection of works and localities often necessitating a full day's absence.

The keenness of a buyer cannot be gauged by his sole inclination to sit in his office each and every day, hoping that the right man with the right goods will call upon him; the best of everything is usually found by search and diligence. Nor is his worthiness to be estimated by his ability to "shut down" even a time waster.

Our own travellers carefully note where prescribed hours are in force and secure their advantages. They do not select mail day for city visiting nor attempt the great London and provincial stores after 10 a.m. except by appointment.

The whole question may, however, be viewed from yet another angle, for is it not unreasonable to suppose that every firm, even in the same industry, should select identical days for the interview of representatives? Travellers should, therefore, be able to arrange their programme with the surety that the result of their efforts would be a full week of effective calls; the ten-and-a-half hour week is thus a pure fabric of the imagination, and is not to be considered as a deterrent to the display of these notices.

Will Mr. C. J. Docherty again read the "arbitrary" notice to callers?

**E. P. Bennett,**
*Joint General Manager, Simplex Conduits, Ltd.*
Birmingham.
*February 6th*, 1922.

### A Distribution Problem.

Our supply here is single-phase, and I have under consideration the matter of relaying a considerable portion of our l.p. distributors, which at present consist of concentric cables. There are, however, considerable lengths of more modern and good triple concentric cables, while it is desirable to interconnect the whole system. It appears, therefore, that the obvious course is to put down new triple concentric distributors, making the system uniform 3-wire. Such would, undoubtedly, be the correct procedure if the system were to remain a single-phase one. We, however, hear much nowadays about bulk supplies, the standard system of such supply being three-phase, and as possibly we may some day be able to secure such a supply, it appears that any new cable work should be designed with that end in view.

I believe that in cases where the bulk of the load is lighting it is usual to adopt a four-wire three-phase system, but such a cable would not work in very well with our triple concentric, and, moreover, I cannot afford to spend a lot of money in anticipation of a visionary scheme which may never materialise. Possibly some of your distribution engineer readers may have been confronted with a similar problem, and if so their views upon this matter would, doubtless, be of interest to other readers equally as much as to myself.

**W. J. U. Sowter,**
Electricity Works, Bray. *Engineer and Manager.*
*January 31st*, 1922.

### Cables for Mining Work.

I should be very pleased if someone would explain how the sizes of v.b., d.w.a. cable are arrived at. My reason for asking is that I have been offered a three-core v.b. d.w.a. cable for a pressure of 500 volts (three-phase) to carry 240 amperes, by a very well-known firm, and another firm (equally well known) will only allow 170 amperes for the same class of cable. Prices are very close together. I have had considerable trouble with the above-mentioned class of cable, and any information on the subject would be very much appreciated.

**Interested.**

*January 29th*, 1922.

### The Dielectric Strength of Solid Insulating Materials.

In reply to Mr. R. T. Norton's letter of January 23rd, I would state that I have recently presented to the I.E.E. a paper giving the results of a very large number of tests on most of the commercial solid insulating materials. This paper has been accepted, and should, before long, be published in the *Journal* of the Institution.

I believe the results contained in this paper will give Mr. Norton the information he requires. If they do not I shall be pleased to give either direct, or through the columns of the ELECTRICAL REVIEW, any other figures and facts which I may be able to supply in this connection.

**W. S. Flight.**

London. *February 1st*, 1922.

### Problems of Distribution.

Mr. W. E. Bradshaw's article in your issue of January 27th opens up a very big subject, and I am glad to see that one supply authority at least realises its deficiencies.

No one will dispute that there is a very big field for electricity, especially for heating and cooking devices, but from the electrical contractor's point of view, the use of heating, cooking, and other appliances will not become general whilst the cost of energy remains what it is.

It always seems to me a cause for regret that there is one rate for lighting, another for power, and sometimes a third rate for heating, involving separate meters and meter rents, separate wiring and switchgear, whilst the gas company only requires one meter and supplies at one rate, irrespective of what the gas is used for.

No doubt the supply companies at present have to keep down the load on account of their inability to meet any seriously increased demand, as is clearly indicated in Mr. Bradshaw's article; at the same time, until the supply companies are in a position to meet such a demand at a reasonable charge for electricity we shall never make much progress in the electrical industry.

In some future age we may have electricity at a flat rate of 2d. or 3d. per unit; one meter, one d.p. ironclad switch and fuses, supplying the light of the house; with 3/20 s.w.g.

circuits feeding to a 15-amp. interlocking switch plug fitted in each room. There may also even be an electric cooking stove.

Mr. Bradshaw mentions 10 amps. for radiators; the size of the radiator naturally depends upon the size of room. For an ordinary suburban house there are plenty of radiators consuming 1,500 watts that give an excellent heat. At the same time, I do think that the designers are making a mistake in increasing the consumption of radiators, as they have done during the past few years; 3 kW now appears to be the standard, and means heavy expense in wiring, especially on 100-volt supply. The aim ought to be to produce a radiator that will give a really good heat, two or three-bar, and not to take more than 1.5 kW full on.

I do not agree with Mr. Bradshaw's suggestion to use 400 volts or thereabouts for electric heating. Think of the trouble with flexible cords and wall plugs at 400 volts in private houses, and think of the number of amateur electricians who like to fit their own wall plugs and flexes. For the same reason I think it will be agreed that 2,000 volts is not practicable for ordinary commercial undertakings; you cannot force a client to have his motors looked after by a qualified electrician, and if you installed 2,000-volt motors it would be asking for trouble.

I can only look at the "Problem of Distribution" from the contractor's point of view, but it seems to me that the solution of distribution lies in increasing the number of feeding points, and in the case of alternating current increasing the number of sub-stations and feeding these at 2,000 volts or more and running short distributors from these points. In the case of the large emporium, it should be made to take supply at high pressure, transformed down on the premises, where there is plenty of room to build a small switch-room or sub-station.

Whilst Mr. Bradshaw's suggestion of subways is unquestionably the right one, the capital cost, especially in a city like London, would be prohibitive, and we must look to simpler and less expensive methods to solve the problem.

**Charles Wyatt, A.M.I.E.E.**

London.
*February 1st, 1922.*

### A Haulage Problem.

Will some readers kindly give their opinions as to the size and rating of a.c. slip-ring motor, and type and rating of a starter for the same, to perform the following duties:—

It is required to raise coal up an incline of 1 in 3½ (underground) at 5 miles per hour; acceleration up to full speed in 25 seconds; weight of coal and tubs, 6 tons. It is proposed to do this by direct haulage, *i.e.*, single rope, and the motor will be required to start and stop 12 times per hour. The motor will be standing, of course, during the time the empty tubs are being lowered down the incline.

What is the usual figure allowed in "lb. per ton weight" to overcome friction of wheels, &c.?

**Inquirer.**

*January 25th, 1922.*

### Revenue from Power Supply at Lighting Rates.

Just a line or two with regard to the answer of Mr. H. Challis-Sowerby in your issue of January 27th. Sorry I used that name "Manchester." My haste—and mistake—also. I admit a more fortunate word than "poor" would have been "small."

The whole argument rests upon the meaning of "small" apparatus. My meaning is 100 to 500 watts, and possibly, in some instances, 600 watts. Of course, classes of consumers vary. One would not compare a district such as Hampstead with one in which there are many "cold tripe" shops. Yet a large supply authority, with a residential load, could hire electric irons, not in hundreds, but thousands, many customers being pleased to pay lighting rate for the small consumption, convenience and cleanliness, rather than meet the expense of a separate power circuit.

The step is one leading upwards. Experience of the use of irons would spread, and other apparatus would be installed which, of course, means a separate circuit; but the lighting rate paid in the schooling stages would be welcome, and lead to larger consumption of energy.

**Interested.**

*January 30th, 1922.*

### Special Rates for Supply to Refrigerating Plant.

I should be extremely obliged if you or any of your readers could give me any instances of special rates being fixed for long-hour running of refrigerator plant by any supply companies or corporations.

**Inquirer II.**

*January 31st, 1922.*

The Utilisation of Waste Heat.—Several communications on this subject have been unavoidably deferred.—Eds. Elec. Rev.

A Notice to Callers.—"Two Workers" are requested to furnish their names and addresses.—Eds. Elec. Rev.

## LEGAL.

Obtaining Lamps under False Pretences.

At Cardiff on Saturday last, William Sullivan was charged with obtaining 12 electric lamp bulbs, valued at £4 10s., by means of false pretences from William B. Young, manager for Messrs. Simpson & Baker, Cardiff. A lad stated that he was standing in the street when defendant came to him and asked him to deliver a note at the premises of Messrs. Simpson & Baker, and to ask for Mr. Young. Defendant accompanied him to the door, rang the bell, and telling him to wait and see Mr. Young, walked away. The note purported to be from Mr. A. Horton, electrical engineer, an old customer of the firm, asking that 12 electric lamp bulbs should be handed to the boy. Being unable to recognise the signature, Mr. Young told the boy to ask Mr. Horton to come himself. The lad, after seeing the defendant again, was sent back with the message that Mr. Horton was too busy to come himself and asked that the bulbs should be delivered to him immediately, as they were required for a job. The goods were then packed and invoiced to Mr. Horton, the boy signing for them. Mr. Horton now stated that the note was not sent by his authority and was not in his handwriting, and a handwriting expert pointed to the similarity between defendant's handwriting and the note. The defendant said he was under the influence of drink and offered to pay for the goods, but the magistrates, saying he had aggravated the offence by making use of the boy, sent him to prison for one month with hard labour.

Metropolitan-Vickers Electrical Co., Ltd., *v.* Chinese Engineering & Mining Co., Ltd.

Sir H. Courthope-Munroe, K.C., as arbitrator appointed by the President of the Institution of Electrical Engineers, sitting at the Surveyors' Institution, Westminster, held a preliminary hearing to determine certain questions of law in a claim by the Metropolitan-Vickers Electrical Co., Ltd. (formerly the British-Westinghouse Electrical & Manufacturing Co., Ltd.), against the Chinese Engineering & Mining Co., Ltd.

The claim was for £2,750, alleged to be due in respect of two contracts, dated March 16th, 1915, and May 15th, 1915, for the supply of turbo-generators, condensing plant, transformers and spare parts. The total value of these contracts was £31,364. The Arbitrator had to deal with questions of law in the construction of the contracts before entering into questions of fact as to an alleged interference by the Government with the claimants' workmen and factory, and as to alleged delay in the provision of buildings and structures.

The purchasers, by way of defence, relied upon the provisions of a schedule to the specification contained in the contract of March 16th, 1915, which was as follows:—

"The contractors (the claimants) undertake to deliver the first set f.o.b. British port, after testing, within 28 weeks from March 16th, namely, by September 28th, 1915, and to deliver the second set, together with the other parts f.o.b. British port, after testing, within 32 weeks from the said date, namely, October 27th, 1915, and on these deliveries being effected at the dates stated the purchasers will pay the contractors the sum of £25,426 18s. Should the delivery of either set be effected at a later date than that stated above, then the purchasers will pay a reduced amount which will be computed by subtracting £250 per week for each week's delay from the £25,426 18s. The number of weeks' delay for this purpose shall be taken as the quarter of the two numbers representing the number of weeks' delay in the delivery of the first set, and the number of weeks' delay in the delivery of the second set, and the maximum deduction for the purpose of this computation shall not exceed the sum of £2,750, being a reduction equivalent to a delay of eleven weeks."

The purchasers alleged that the claimants did not deliver the first set by September 28th, 1915, nor the second set by October 27th, 1915, and did not deliver them until after a delay of more than eleven weeks, computed in accordance with the provisions of the schedule. Therefore, it was submitted, the contract price payable by the purchasers for the two sets was less than the sum claimed by £2,750.

The claimants, in reply, alleged that, first, the schedule was in the nature of a penalty clause, and the purchasers were not entitled to benefit by it or to make any deduction except on proof of damage caused by delay on the part of the claimants in making deliveries under the first contract, and that no damage was or could be alleged by the purchasers. Secondly, it was provided by the schedule that the purchasers should grant under their hand such extension of time for the completion of the work as might seem reasonable to them in the event of the Government at any date subsequent to March 16th, 1915, by virtue of the Defence of the Realm Act or any amendment of it, interfering with or commandeering the employés or portion of the contractors' or subcontractors' factory, either or both of which were essential for the construction and due delivery of the work. In the construction and delivery of the work, it was pleaded, the claimants' workmen and factory were interfered with by the Government within the terms of the clause, the pur-

chasers had notice thereof, and in consequence the claimants became entitled to an extension of time for the delivery of the works. The purchasers, it was submitted, did not comply with a covenant as to granting an extension of time or giving notice of any limited extension, and in consequence the claimants became released from all liability to deliver the goods or any of them by any fixed date. Thirdly, it was pleaded, on the true construction of the contract, the claimants could not be called upon to commence any work which was of the nature required—building or structure—for the reception or efficient installation of the works, and which building or structure had to be provided by the purchasers unless and until such building or structure should be in a condition sufficient for the reception or efficient installation of the plant; and that the contract should be extended *pari passu* with the delay in providing any such building or structure. In fact, it was submitted that at the time it was claimed plant should have been delivered the buildings for its reception had not been completed, and therefore the claimants were not liable for the delay in delivery. Finally, it was said, the purchasers had expressly or impliedly waived compliance by the claimants with the terms of the schedule as to the dates of delivery.

The Arbitrator reserved his award, which is to be stated in the form of a special case.

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### Electrician Sentenced.

An electrician was sent to prison for four months by the Liverpool Stipendiary for stealing two sums—£7 5s. and £5 5s.—which had been entrusted to him to pay a lighting deposit to the Liverpool Corporation.

It was stated that in January, 1920, a draper in Great Homer Street, Liverpool, employed the defendant to install electric lights at his premises, paying the sum of £14 10s. for the work. Three months after a sum of £7 5s. was paid him to obtain a meter from the Corporation Electric Lighting Department and to pay the lighting deposit. The tenant of the premises gave him a further £5 5s. to perform a similar service for his brother.

The stipendiary described the case as one of gross and deliberate fraud.

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### Compensation Case Dismissed.

At the Dunfermline Sheriff Court, recently, an employé of the Fife Coal Co., Ltd., sued his employers for compensation for injuries sustained during his employment as a miner. The evidence showed that plaintiff had prepared a charge for blasting and the authorised shot-firer, under the Explosives in Coal Mines Order, was present. The shot-firer, instead of coupling up the detonator himself threw the end of a wire to plaintiff, who made the connection. The shot-firer then left the heading and connected the wires to the firing battery. Some trouble was present and the shot did not explode. The shot-firer then withdrew the wires from the detonator and replaced them. Upo nhis making contact again the charge exploded and injured the plaintiff, who was standing near. The Sheriff, in dismissing the case, said that two contraventions of the Order had occurred. The plaintiff was wrong in connecting up the wires and the shot-firer failed to see that the heading was clear before making contact.

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### Electro-Magnetic Separator Patent.

According to reports in the daily Press, judgment has just been given by the Appeal Court of the German Patent Office on an appeal entered by Fried. Krupp A.G., of Grusonwerk, Germany, against the grant of a German patent applied for by H. H. Thompson and A. E. Davies (of the Rapid Magnetting Machine Co., Ltd., of Birmingham). The case has dragged on since 1917, the action being connected with an electro-magnetic separator for separating feebly magnetic ores from other ores, and from each other, by means of a high-intensity magnetic separator, for which patents have already been granted in England, America, France, and many other countries. The opposition of Messrs. Krupps was successful in the Examination Department, but the English inventors appealed. After the hearing of the appeal the higher court decided that there was a patentable invention, but they required a practicable demonstration in Berlin of the machine to prove that it was commercially possible to do what the inventors claimed. The English inventors dispatched a machine to the German Patent Office, and went over to Berlin in November last. After a series of experiments the decision of the tribunal was reserved, but it has now been issued, annulling the decision of the lower Court and allowing the patent.

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### Blombach *v.* Grimes & Hawkes, Ltd.

In the Shoreditch County Court, last week, before Judge Cluer, Carl Blombach, of Ronadorf, near Remscheid, Germany, electrical goods' dealers and hardware merchants, sued Messrs. Grimes & Hawkes, Ltd., dealers in hardware and electrical goods, of 63, Great Eastern Street, E.C., to recover £18 14s. 3d. Mr. A. E. Robinson appeared for the plaintiffs, and Mr. E. Hancock for the defence. When the case was called on Mr. Robinson applied for an adjournment, he being unable to proceed, as his client was in Germany. An application was then made by the defendants for the costs thrown away, whereupon Judge Cluer remarked: "What chance have I of getting the costs. I cannot go to Germany to get them." Finally, the hearing was adjourned on the understanding that the costs were paid in seven days.

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### British Thomson-Houston Co., Ltd., *v.* Corona Lamp Works, Ltd.

In the Chancery Division on Monday, Mr. Justice Astbury commenced the trial of an action by the British Thomson-Houston Co., Ltd., against the Corona Lamp Works, Ltd., for an injunction to restrain an alleged infringement of patent.

Sir. A. Colefax, K.C., appeared with Mr. J. H. Gray, K.C., Mr. Whitehead and Mr. Trevor Watson, for the plaintiff company and Sir D. Kerly, K.C. and Mr. Frost for the defendant company.

Sir Arthur Colefax said the patent (No. 23,775 of 1912) was for improvements in and relating to evacuated vitreous containers having sealed-in conductors. The patent had been sometimes referred to, he thought rather erroneously, as the leading-in wire patent; at any rate, it was concerned with the seal between the glass and the leading-in wire in an incandescent lamp. So far as the infringement went there were certain admissions of fact. There was an admission relative to title. There were two cases, one of one lamp and the other of 12 lamps, with respect to the issues raised by way of defence, and so far as the particulars of objection went they were the usual issue. The defendants denied novelty, subject matter, and utility, and they pleaded prior users. Since the early nineties proposals had been made to obviate the use of platinum for the leading-in wire, but until the date of the patent in question, with one or two exceptions, platinum was universally used, and since the date of the patent plaintiffs' inventions had steadily displaced platinum. The embodiment of the invention as practised to-day was this: from an alloy with a coefficient of expansion less than that of glass, a composite wire was made. This core was then coated with a sheath which, presumably had a different coefficient of expansion, in the form and embodiment in which it was used. Copper was taken, which had a higher coefficient of expansion than glass, but whatever was selected for the sheath it was oxidisable, and the oxide was easily soluble in the glass into which the leading-in wire was put in the operation of sealing. In the specification of the patent the alloy was nickel-iron, the ratio being 46 per cent. nickel and 54 per cent. iron. In the alleged infringing lamps, the alloy in the composite wire was 29 per cent. copper, 28.43 per cent. nickel and 42.4 per cent. iron—99.83, there being a little loss in analysis.

Evidence in support of the plaintiffs' case was given by Mr. Jas. Swinburne (electrical expert) who said that platinum being expensive the object of the inventor in this case was to get some other metal with the two advantages of platinum: (1) that the glass would wet the platinum when it was hot, and (2) that it would adhere when it was cold. In the case of platinum they must have a bright surface and a coefficient of expansion the same as that of glass. If they did not use platinum they must have a base metal and use it in such a way that the glass would adhere and that the expansion would not break the glass. These two properties were found in the metal used in these lamps.

The hearing was continued on Tuesday. In cross-examination by Sir D. Kerly, who asked if it was common knowledge at the date of the patent, that if they wanted to use any leading-in wire the coefficient of expansion of the wire and of the glass they were using must be approximately the same, Mr. Swinburne said he should hardly say it was common knowledge. It was only when they used fairly large wire that the coefficient of expansion played an important part. He thought everybody at this date would suppose that it was an advantage to have them exactly the same. The ordinary variations of tempearture were not really the important thing, the real variation of importance was the difference of temperature between the time of sealing and the atmosphere; it was very seldom raised above, or came anywhere near, those limits afterwards in practice.

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### Accumulators, Ltd., *v.* Australian Commonwealth.

In this case the plaintiffs, manufacturers of electrical plant, sued the Commonwealth Government for the value of a counter-e.m.f. battery supplied to the Postal Department (*vide* Elec. Rev., December 30th, 1921, p. 880). The hearing was concluded on December 9th, after the hearing of a great amount of technical evidence bearing upon the suitability and capability of the battery, which the Government declared to be not according to specification.

Mr. Justice Ferguson gave judgment in favour of the plaintiff firm, and awarded the sum of £1,190, but ordered a stay of proceedings.

# BUSINESS NOTES.

**Bankruptcy Proceedings.**—Ernest Fawcett, 20, St. Anne Street, Liverpool, electrical and heating engineer.—The first meeting of creditors was held on February 1st at the offices of the Official Receiver, 11, Dale Street, Liverpool. The receiving order was made on debtor's own petition. The statement of affairs showed unsecured liabilities of £348, while the net assets were estimated to realise 14s. 11d. Debtor attributed his failure to the liquidation last June of a limited company in which he was interested, and in connection with which he estimated that he had lost £500. He also put down as a loss £250 on a bank guarantee for the company. Debtor served an apprenticeship to an electrical, heating and hydraulic engineer, and was for a number of years in the employ of various engineering firms. In August, 1920, he invested in and became one of the directors of an electrical company, and in the following November he guaranteed jointly and severally with the other two directors the bank overdraft of £500. Owing to the slump in trade, the company went into voluntary liquidation on June 1st, 1921. On July 21st last year debtor entered into partnership with another person, and the two carried on business at 20, St. Anne Street, Liverpool, as electrical and heating engineers, the debtor being entitled to half profits and a salary of £4 per week. His partner provided the whole of the partnership capital, and the agreement was that the partnership should be dissolved on the bankruptcy of either partner. The debtor estimated that his interest in the partnership was at present valueless. In connection with the partnership a firm of business agents had obtained judgment against the debtor personally for £25 and costs for commission in introducing the partner with capital. No books of account were kept by the debtor in connection with his private estate. He became aware of his position in June last. The matter was left in the hands of the Official Receiver as trustee.

Robert Adrian Depledge, 53, late 102, Frodingham Road, Scunthorpe, Lincolnshire, electrical engineer.—The public examination of this debtor was held on February 2nd at the Town Hall, Great Grimsby. The statement of affairs showed gross liabilities of £3,017, of which £1,545 was expected to rank for dividend, and there was a deficiency of £814. Debtor attributed his failure to bad trade, want of capital, and loss on forced sales under executions. It appeared that he started business at 1b, Wells Street, in 1912, with £15 capital. Later he transferred the concern to Frodingham Road. The business had only been a small one. After further questions, the examination was adjourned. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Baxendale & Co., Ltd. ... ... | 76 | Premier Accumulator Co., Ltd. | 52 |
| Butterick, J. E. ... ... ... | 16 | Quibell, D. J. K. ... ... ... | 457 |
| Crossley Bros., Ltd. ... ... | 158 | Thursfield, C. J. ... ... ... | 13 |
| Callender's Cable Co., Ltd. ... | 105 | Todd, J. H., & Sons ... ... | 22 |
| English Electric & Siemens Supplies, Ltd. ... ... ... | 27 | Verity, E. ... ... ... ... | 33 |
| General Electric Co., Ltd. ... | 103 | Walsall Electrical Co., Ltd. ... | 34 |
| Morley, J. B.,& Co. ... ... | 139 | Dickinson, W. ... ... ... | 28 |
| Manchester Lighting Co., Ltd. | 155 | Smith, A. H. ... ... ... | 60 |

Edward Fuller Heath (trading as Fuller, Heath & Co.), electrical engineer, 26, Buckingham Gate, S.W.—The first meeting of creditors under this failure was held on February 2nd, before Mr. F. T. Garton, Official Receiver, at the London Bankruptcy Court. The receiving order was made on January 18th upon the petition of the Danish Machine Co., creditors for £300. The Chairman reported that the debtor commenced business as an electrical engineer in January, 1919, at Cannon Street House, E.C., but owing to the liquidation of a large electrical company, by which he lost £1,000, he executed a deed of assignment. Six months later he recommenced business as an electrical and mechanical engineer at 26, Buckingham Gate, with a capital of £100. Owing to strikes and other difficulties he was unable to carry on, the failure being further attributed to ill-health and want of capital. The liabilities were roughly estimated at £2,000, against assets valued at £135, and in the absence of any offer the case was left in the hands of the Official Receiver to be wound up in bankruptcy.

T. Scott and J. Campbell (T. Scott & Co.), wholesale electrical suppliers, 42, Handyside's Arcade, Percy Street, Newcastle-on-Tyne.—Receiving order made February 2nd on debtors' own petition. First meeting, February 21st, at Newcastle-on-Tyne; public examination, February 23rd.

C. Stanton (Southern Electrical Engineering Co.), electrical engineer, 25, Beckenham Road, Penge.—Trustee (Mr. T. Gourlay, Official Receiver, 132, York Road, S.E.), released January 13th.

James Joseph Smith, trading as J. Smith & Son, electrical engineer, of 1, Central Street, E.C.1.—The public examination of the above-named debtor was concluded at the London Bankruptcy Court on February 7th. The receiving order was made on November 24th, 1921, and the liabilities expected to rank for dividend were estimated at £321. No assets were disclosed. From 1910 until 1919 debtor carried out electrical work from his private residence, and in March, 1919, he took premises at 1, Central Street, St. Luke's, E.C., where he commenced to trade with a capital of about £60 under the style of J. Smith and Son. The business was profitable at first, but owing to strikes it fell off, and in October, 1921, the tenancy of his premises was transferred to his wife, who had since carried on the business under debtor's management. He attributed his insolvency to loss of business owing to strikes and to the slump in trade. Although he traded as J. Smith & Son, he had no partner. He had never been bankrupt before. The examination was concluded.

**Company Liquidations.**—The Phonopore Construction Co., Ltd., the Phonopore Works, Scott's Road, Southall, Middlesex.—The winding-up order in this matter was made on November 10th, 1921, and the statement of affairs shows liabilities £6,019, of which £2,445 is due to unsecured creditors. The assets are estimated to realise £1,957, from which preferential claims of £1,000 have to be deducted, leaving net assets £957, which are not sufficient to meet the claims of the debenture holders, which amount to £4,531. The company was registered as a private company on March 29th, 1916, and was formed generally to carry on the business of manufacturing telephones, &c., and to take over interests under an agreement with the New Phonopore Telephone Co., Ltd. The consideration was £175, which was satisfied by the issue of 3,500 fully-paid founders' shares of 1s. each. The nominal capital of the company is £4,175 divided into 3,500 founders' shares of 1s. each, issued as fully paid, and 4,000 ordinary shares of £1 each, the whole of which latter were issued in 1916 to subscribers for cash, and have been fully paid up. The company carried on the business of manufacturing telephones for the Army until June, 1917, when the works were commandeered by the War Office, being restored only in January, 1919. On October 19th, 1921, a resolution for the voluntary liquidation of the company was passed, and a liquidator appointed, but that appointment has been superseded by the winding-up order. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Abrahams & Co. ... ... | 20 | Micanite & Insulators, Ltd. ... | 24 |
| Bankers ... ... ... ... | 219 | Mica & Micanite Supplies, Ltd. | 470 |
| Burton, Griffiths & Co. ... | 12 | Phœnix Telephone Works, Ltd. | 180 |
| Brown Bros. ... ... ... | 44 | Preen (Arthur) & Co. ... ... | 14 |
| Blackwell, R. W. ... ... | 14 | Reliance Engraving ... ... | 15 |
| Cox, T. C. ... ... ... ... | 267 | Auto Engineers ... ... ... | 12 |
| Canning (W.) & Co., Ltd. ... | 40 | Underwood & Newberry ... ... | 15 |
| Caversham Motors, Ltd. ... ... | 35 | Wood, J. E. ... ... ... | 16 |
| Collins' Electrical Co., Ltd. ... | 14 | Beaton, Uriah ... ... ... | 14 |
| Creamo, Ltd. ... ... ... | 12 | Sheath Bros. ... ... ... | 20 |
| Central Translations Inst., Ltd. | 42 | Submersible Motors, Ltd. ... | 24 |
| Farmer & Co. ... ... ... | 102 | Smith & Sons ... ... ... | 40 |
| Hatcham Manufacturing Co. ... | 43 | Sterling Telephone Co. ... | 22 |
| Hampton & Sons ... ... | 10 | Telegraph Condenser Co., Ltd. | 102 |
| King & Hutchings ... ... | 68 | Varley Magnet Co. ... ... | 203 |
| Lavington (1916), Ltd. ... | 64 | Wall, G. P. ... ... ... | 12 |
| Lewis, James ... ... ... | 10 | Jones, Son & Andrews ... ... | 73 |
| Mosses & Mitchell ... ... | 10 | Finlay, Braden & Co., Ltd. ... | 59 |

Stockwell & Ohms, Ltd., electrical power contractors, 164a, Pentonville Road, London, N.—At a meeting of creditors held on February 3rd it was decided that Mr. W. Osborne, of Messrs. Corfield & Cripwell, should be appointed as joint liquidator with Mr. Holmes, with a committee of inspection consisting of representatives of Messrs. Crompton & Co., Ltd., the English Electric Co., Ltd., and the General Electric Co., Ltd. A report of the proceedings will appear in our next issue.

Goodall Electric, Ltd.—Winding up voluntarily. Liquidator: Mr. A. G. Turner, Liberty Buildings, School Lane, Liverpool; meeting of creditors, February 15th, at 64, County Road, Walton.

Producer Gas Plants, Ltd.—Meeting of creditors, February 17th, at 19, Eastcheap, London, E.C. Joint liquidators: Messrs. W. H. Cork and J. J. Middleton.

Frank Rawcliffe & Co., Ltd.—Winding up voluntarily. Meeting of creditors, February 16th, at 50, Gresham Street, E.C.—Liquidator: Mr. W. Brittain, 15, Pilgrim Street, Newcastle-on-Tyne.

Sutton-in-Ashfield Motor and Electrical Engineering Co., Ltd.—Mr. A. G. Mellers, of 1, King John's Chambers, Nottingham, ceased to act as receiver on January 28th, 1922.

Pearlite Electric Welding Co., Ltd.—Meeting called for March 6th at Bank Buildings, St. James' Street, S.W., to hear an account of the winding-up from the liquidator, Mr. J. C. Burleigh.

S. Gillitt & Co., Ltd., electrical engineers, Newcastle-on-Tyne.—A petition for the winding-up has been presented to the County Court of Northumberland by Fenwick, Ltd., and will be heard at the Court House, Newcastle-on-Tyne, on February 16th.

J. Freeman & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. H. Bridgewater, 3, New Street, Birmingham, to whom claims should be sent by February 28th. Meeting of creditors, February 14th, at 95, New Street.

**Dissolution of Partnership.**—Household Work Co., electricians, carpenters and joiners, &c., 6a, The Avenue, Ealing. Messrs. E. Smead and W. J. Borlase have dissolved partnership. Mr. Smead will attend to debts and continue the business.

**Catalogues and Lists.**—Mr. George Ellison, Perry Barr, Birmingham.—List No. 141, dealing with resistances for the speed regulation of slip-ring induction motors, and current regulation. Illustrated and priced.

Messrs. Clement Talbot, Ltd., Barlby Road, Ladbroke Grove, W.10.—"The Book of the 8-h.p. 'Talbot,'" giving specifications and descriptions.

The West Yorks. Electrical Co., Ltd., Halifax.—An illustrated pamphlet giving details of the "Wyeco" patent cable suspender.

Messrs. Lacy-Hulbert & Co., Ltd., 91, Victoria Street, S.W.1.—List ELB 5, giving an illustrated description of the "Boreas" portable electric air-blast machine.

Messrs. T. M. Johns & Co., Farley Chambers, Union Street, Plymouth.—A leaflet illustrating an electric gas-lighting appliance. Priced.

Messrs. Newton & Wright, Ltd., 471-473, Hornsey Road, N.19.—Illustrated and priced leaflet (Section 2b) describing deep therapy apparatus.

The International Electrolytic Plant Co., Ltd., City Electricity Works, New Crane Street, Chester.—An illustrated reprint from *Engineering*, describing the Hyde welding process.

Mfssrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.1.—Catalogue 106, a list of reduced prices of twin flexible cords with various coverings.

Messrs. Dieny & Lucas, 329, High Holborn, W.C.1.—Two illustrated pamphlets (one in French), advertising gas engines, electric motors, and other machinery made by the Société Alsacienne de Constructions Mécaniques, for which Messrs. Dieny & Lucas are sole agents in Great Britain, the Colonies, &c.

The B.E. Co. (of London and Birmingham), Ltd., 57, Upper Thames Street, E.C.4.—A list of current prices of electrical accessories.

The Hotpoint Electric Appliance Co., Ltd., 21, Berners Street, Oxford Street, W.1.—An illustrated pamphlet describing several types of "Hotpoint" irons.

International Time Recording Co., Ltd., 57, City Road, Finsbury, E.C.1.—A booklet describing the firm's time-recording systems, containing numerous illustrations and reproductions of card records. Also a price list.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Monthly Magazine for February, containing the usual stock lists, notes on ball bearings, and humour.

The Record Electrical Co., Ltd., Broadheath, Altrincham.—A "perpetual" calendar in the form of an ammeter scale, with divisions running from zero to 31. The day and month appear in openings in the dial.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Installation leaflet, No. P 2554, being an illustrated description of the electric drive in Messrs. Palmers' Shipbuilding and Iron Co.'s yards at Hebburn-on-Tyne. Leaflet No. C 2535, illustrated and priced, containing full details of new flame-proof mining-type boxes for colliery lighting, &c. Pamphlet F 2694, an illustrated list of English alabaster bowl fittings. Fully priced.

Messrs C. J. Ferguson & Sons, 54, Chiswell Street, London, E.C.1.—Illustrated pamphlet giving information regarding their facilities for promptly carrying out power installations and repairing electrical machines. A separate circular particularises the large stock of motors held (February).

Messrs. Clough, Smith & Co., Ltd., 36, Victoria Street, S.W.1.—An illustrated brochure describing the "Straker-Clough" trolley-'bus.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.4.—A publication entitled "Economic Electric Power Transmission," dealing in detail with the use of aluminium transmission lines, with special reference to their erection.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—Monthly price list of electrical accessories, including batteries, bells, conduit fittings, switches, and fuses.

Messrs. John M. Henderson & Co., King's Works, Aberdeen. List 40-2E.—A well-illustrated catalogue of electrically-driven overhead cranes. The list is in four languages: English, French, Italian, and Spanish.

Messrs. Edwards Bros., 20, Blackfriars Road, S.E.1.—Price lists of motors and electrical accessories of all kinds.

**Trade Announcements.**—The Sheffield Electric Co. has opened premises at 3, Paradise Square, Sheffield, as electrical agents and factors, and desires to receive catalogues and lists.

Messrs. Chas. Churchill & Co., Ltd., have been appointed the sole selling agents in Great Britain for the automatic screw machines and various auxiliary machines manufactured by Joseph Petermann, Moutier, Switzerland.

The Freeman Electrical Accessories Co. have temporarily removed to 156, Whitechapel Road, E.1.

Mr. P. J. Weekes, who was for 12 years with Messrs. Siemens, has now opened works at Lombard Street, Southwark Bridge Road, S.E.1, to manufacture switchboards, fuseboards, &c., and desires to receive catalogues of instruments, switches, fuses, iron cases, &c.

**Private Arrangement.**—J. Nelson Bardsley, 179, Katherine Street, Ashton-under-Lyne, electrical fitter, &c.—The creditors interested herein met recently at the offices of Messrs. Harry L. Price & Co., Fountain Street, Manchester, when a statement of affairs was presented, which showed liabilities of £1,250, of which £724 was due to the trade, while there was one cash creditor for £195, and the bank was scheduled as a creditor for £320. The assets totalled £387, thus leaving a deficiency of £863. Debtor started in business in August, 1919, having previously been a journeyman plumber. He attributed his position to loss through two motors not being of any use, and collision of one, illness of self, competition, and cutting of prices. Only a rough set of books had been kept, and these had been imperfectly made up.

The matter was discussed, and it was eventually resolved that the estate should be dealt with under a deed of assignment. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Crowther & Osborn, Ltd. ... | 14 | Beardsall (W. E.) & Co., Ltd. | 15 |
| Samuel Gratrix, Junr. & Bros., Ltd. ... ... ... ... | 241 | Power & Lighting Supplies Co. | 14 |
| Booth & Son ... ... ... ... | 10 | Wholesale Fittings Co., Ltd. ... | 14 |
| The Park Electric Engineering Co. ... ... ... ... | 262 | Giddings & Dacre, Ltd. ... ... | 12 |
| B.T.T. Electric Lamp & Accessories Co. ... ... ... | 42 | Holmes, W. ... ... ... | 41 |
| | | Bardsley, Mrs. M. A. ... ... | 192 |
| | | Bankers ... ... ... ... | 320 |
| | | Baxendale & Co., Ltd. ... | 40 |

**Electricians' Wages.**—At a conference that was held on January 26th between the National Federated Electrical Association and the Electrical Trades Union, the following clauses were added to the national standardised wages agreement of August 7th, 1920:—

1. *Ship Work.*—This Conference recommends to the District Committees of the N.F.E.A. and the E.T.U. that the N.F.E.A. rate for electrical work on ships shall be the ship rate or the district for the same class of work where necessary local agreement should be come to as to the ship rate which is current in the district.

2. *Shore Work.*—The E.T.U. representatives undertake to instruct their members not to work for any employer federated to any federation, or otherwise on the wiring or installation of any new work in new or old buildings at less than the N.F.E.A. rate.

3. That the rates agreed between the E.T.U. and the Engineering and the Shipbuilders' Employers' Federation are restricted to maintenance work and exclude all new wiring or installation work.

4. A sub-committee be appointed to deal with any grievances under the above clauses.

In accordance with the national wages agreement entered into by the N.F.E.A. and the E.T.U. on August 7th, 1920, and September 22nd, 1921, the sub-committee, consisting of Messrs. H. J. Cash and J. Orringe (N.F.E.A.) and J. Rowan and J. Kinniburgh (E.T.U.), appointed to give effect to the agreements, has declared that the variation in the cost of living justifies a 16 per cent. reduction in wages in lieu of the previous reduction of 10 per cent., and that the net hourly rates of pay are as follows:—Grade A, 2s. 1½d. (This rate includes a travelling allowance; no further allowance to be paid, except as provided by Rule 9 of the London rules dated February, 1920.) Grade B, 1s. 10½d. Grade C, 1s. 9d. Grade D, 1s. 7½d. The above rates come into effect for the period covered by the second pay-day in February, 1922, and will remain current up to and including the period covered by the first pay-day in June, 1922. Grade C now includes Cambridge Town and Londonderry; Kent, outside the London area, and Tunbridge Wells have been transferred to Grade D, with the exception of the following towns in Kent:—Chatham, Faversham, Sheerness, Gravesend, Crayford, Sittingbourne, Rochester, Dartford, and Maidstone.

The N.J.I.C. for the electrical contracting industry at its meeting held at York on January 27th, unanimously ratified in the following form the agreement arrived at by the N.F.E.A. and E.T.U. on January 26th to delete clause 3 (country allowance) of the agreement dated February 24th, 1921, and substitute the following in lieu thereof:—

3. (1) The country allowance, which shall be paid to men sent to jobs which necessitate their lodging away from home, shall be at the rate of three shillings and six pence per night for the first fortnight and three shillings per night afterwards.
   (2) The above rates to come into effect on the second pay-day in February, 1922, for the pay period covered by that pay-day.
   (3) Payments are to be made:—
      (*a*) When the men in the employment of a firm are sent to an out-lying job necessitating their living away from home, subject to 4 (*c*).
      (*b*) When men are engaged by a firm at their ordinary office and are sent to such out-lying jobs.
   (4) Payments are not to be made:—
      (*a*) When men living in the locality of such out-lying jobs apply on the job for work.
      (*b*) When the employer advertises that men are required on an out-lying job, and the men apply for work at the job.
      (*c*) When suitable board and lodging is found for the men free of expense to them.
   (5) When men on out-lying jobs are in receipt of country allowance they carry with them the rate of wages of the district from which they are sent, but not otherwise. And when local men are started on out-lying jobs they shall receive the rate of the district where they are employed.

**Electrical Wages Dispute at Cape Town Settled.**—The dispute in the electrical trade was settled on the terms that the wages be 2s. 11d. per hour to the men now receiving the highest rate of pay, with a minimum rate for men of over five years' service of 2s. 4d. per hour. Men not now receiving the highest rate of pay must obtain a licence from the Examining Board, to be formed under the Ordinance recently promulgated, before they can be considered eligible for the highest rate. These rates are to remain in force until March 31st.

**Book Notices.**—"The Faraday House *Journal*," Vol. IX. No. 5.—This issue contains an article by the Principal on "The Power Factor and the Equal Phase Volt-amperes of a Polyphase Load"; an illustrated note on hydro-electric development; and a list of examination results.

"The *Bulletin* of the Hydro-Electric Power Commission of Ontario," Vol. VIII. No. 6, November-December, 1921.—The principal features of this number are a review of distribution work in rural areas, and a description of the Commission's meter and instrument repair service.

"*Journal* of the Institution of Electrical Engineers," Vol. LX. January, 1922. No. 305.—The issue contains the following papers:—"Telephone Line Work in the United States," by Mr. E. S. Byng; and "The Cyc-Arc Process of Automatic Electric Welding," by Messrs. L. J. Steele and H. Martin. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Is Trade Unionism Sound?" by J. H. Bunting. Pp. x+98. London: Benn Bros., Ltd. Price 2s. 6d.—This is a second, and cheaper, edition of the work reviewed in our issue of September 23rd, 1921 (p. 405).

"Garcke & Fells: Factory Accounts." Pp. xx+290; 5 diagrams. London: Crosby Lockwood & Son. Price 15s. net.

"The Production of Socialist Labour as Tested by Results—The History of Socialist Failures," by W. H. Mallock. London: The Liberty and Property Defence League.

"Lockwood's Builder's and Contractor's Price Book for 1922." London: Crosby Lockwood & Son. Price 7s. 6d. net.

"The *Journal* of the South African Institution of Electrical Engineers," Vol. XX. No. 6, January, 1922.—The principal paper reproduced in this number is "Coal-cutting by Machinery," by Mr. A. Shearer.

**A Belgian Co-operative Electrical Company.**—We are informed that a co-operative company has been formed under the title of the Entreprises Générales d'Electricité Belges et Etrangères, at 34, Rue Van Schoor, Brussels, with a capital of 250,000 fr., divided into 250 parts of 1,000 fr. each. The object is the purchase, sale, manufacture, importation and exportation of wires and cables for all kinds of electrical purposes, insulating tubes and accessories, insulating material, and material for the construction of aerial and underground lines and of tramways, &c. Among the founders (promoters) of the company are to be found the names of M. Jannsens, of Schaerbeek, who brings in to the company his commercial organisation, and subscribes most (207) of the parts; M. Vallez, commercial director of the Electric Cable & Conduit Co., of Laeken; the Société Francaise de Cables Electriques et Tubes Isolateurs, of Thionville; M. E. V. E. Coenas, of Upper Norwood, S.E.; and the Standard Electric Cable and Equipment Co., of 11, Tottenham Court Road, W. The latter, however, does not appear to have taken up any of the parts.

**The Stone Cement Works.**—We are informed by the Premier Cooling & Engineering Co., Ltd., that the air filter used on the Brush-Ljungstrom turbo-generator described in our last issue, in connection with the Stone cement works, was manufactured at the company's works at Shalford, Surrey.

**Financial Review of 1921.**—The Intelligence Department of the Federation of British Industries has published a 32-page pamphlet which is a financial review of 1921 by Messrs. J. S. M. Ward & A. L. Pease. It includes charts and notes showing the fluctuations in the rates of foreign exchange and the prices of the raw materials of industry.

**An Industrial Survey.**—In the course of an industrial survey of the United Kingdom, the *Board of Trade Journal* says that everyone is looking hopefully for the promised revival of trade, and there are faint signs that these hopes are likely to be fulfilled, but many uncertain factors remain. Raw material prices, with few exceptions, continue to fall, and further wage reductions have taken place in many industries, resulting in a lowering of the prices of manufactured goods, and enabling British makers to compete more effectively with their foreign rivals. The increased facilities provided by the new Export Credits Scheme have been taken advantage of, and a considerable amount of trade has been done which would not otherwise have been possible. The proposed International Corporation for reviving trade on the Continent should hasten recovery, and if a satisfactory settlement of the reparations problem can be achieved a great step will have been taken towards the establishment of conditions in which stable trade relations are again possible. Stability is the main essential, for as long as prices and costs remain unstable buyers hold aloof and refuse to enter into long-period contracts. The improvement in the iron and steel industry proceeds but slowly. Although costs have fallen substantially both in respect of wages and raw materials, the feeling that prices have not reached rock-bottom still prevails, and business is suffering in consequence. With regard to engineering and hardware, notwithstanding the greatly increased capacity for production as compared with the pre-war period, most branches of the industry remain in a very depressed condition. Electrical engineering, however, both in its light and heavy branches, is an exception. Exports of electric lamps exceed in number those of pre-war years, whilst cable exports, though not up to the standard of a year ago, are still equal to the pre-war average. Railway engineering workshops are also well employed, both on account of repairs and export business.

**The Utrecht Fair.**—So great was the success of the previous Fairs at Utrecht that a permanent building has been constructed to house the exhibition, and this will be used for the first time for the Fair which is to be held from February 21st to March 3rd. There will be sixteen sections, including those devoted to electricity and machinery; agriculture; industrial supplies; and "economical services." The groups are to be arranged according to their nature irrespective of nationality.

**Unemployment.**—A further decrease in unemployment is manifested in the latest available Ministry of Labour returns. The total on January 24th was 1,915,700, as compared with 1,925,900 a week earlier. Relief schemes were reported to have absorbed 121,500 persons, as at January 20th.

**Electricity Supply Rifle League.**—The following are the results of the matches completing the 1921 season: City Co., 579; St. James', 539. County Co., 566; Fulham, 545. County Co., 581; Central, 576. Central, 573; Fulham, 550. Shoreditch, 588; Fulham, 537. St. James', 568; Fulham, 529. Central, 561; Hackney, 519. Shoreditch and the City Co. headed the table, and as a result of a tie shoot Shoreditch finished first.

**The Johannesburg Strike.**—The week's developments upon the Rand have been perplexing, sometimes indicating the approach of a settlement and sometimes pointing to serious disorder. On February 1st the Germiston strike committee suggested the appointment of an arbitration court of five members, and further called for a change in the personnel of the men's leaders. Benoni coal miners were reported to have returned to work, and at the same time the Pretoria railway workers declared against a general strike. The Johannesburg tramways recommenced running on February 2nd, and larger supplies of electricity were available. The New Kleinfontein and Modder East mines were stated to be in a precarious condition, due to flooding. *Reuter* reported, on February 3rd, that the Workers' Federation had agreed to the Government's endeavouring to find a way out of the *impasse*, but later messages indicated serious trouble. It was said that the "commandoes" were going to prevent by force the continuance of essential services.

**An Electrical Federation in Victoria.**—We read in the *Industrial Australian and Mining Standard* that the Electrical Traders' and Contractors' Association of Victoria is being wound up, and the members have formed a new body, entitled, "The Electrical Federation (Victoria)," with a considerably broader constitution. The object of the new Federation is the betterment of the electrical industry to the mutual benefit of its members and the advancement of the use of electricity. A whole-time general manager is to be appointed. At the inaugural meeting the first officers were elected, the president of the Federation being Mr. T. M. Ritchie, the vice-president Mr. L. G. Hinwood, and the hon. treasurer Mr. G. L. Just.

**Electric Railways Dispute.**—In official railway circles very little doubt is entertained that the reported threatened trouble on the electrically-operated railways of the country and the London Tubes will be averted. The Electrical Trades Union and the National Union of Railwaymen have made joint representations to the Ministry of Labour regarding the 12½ per cent. reduction on wages for electrical workers and engineers employed in power stations, including Lots Road, Chelsea, which supplies practically the whole of the London underground system. The unions contend that the railway companies had proposed to introduce a reduction at very short notice and without negotiations. A deputation from the Electrical Trades Union and the National Union of Railwaymen met Sir David Shackleton last week at the Ministry of Labour, and he informed the deputation that he had been in touch with the employers, and the proposed conference to discuss the reductions would probably be put forward in about a week's time.—*Daily Telegraph.*

At a conference of both sides, held on February 7th, a provisional settlement was reached. This is to be submitted for approval to the companies and the men.

**Social.**—The annual dinner of the staff and employés of Messrs. Ernest F. Moy & Co., Ltd., was held on January 28th. Mr. J. W. Hopkins, M.P. for South-East St. Pancras, and the Mayor of the Borough were among the guests and replied to the toast of "The Visitors." Mr. E. F. Moy, replying to the toast of "The Firm," said that he hoped before long to reinstate those whose discharge had been necessitated by the bad state of trade. A musical programme was presented during the evening.

**The Brussels Commercial Fair.**—We have received a small prospectus of the Third Official Commercial Fair which is to be held in Brussels from April 3rd to 19th, together with a form of application for space. Free tickets of admission are offered to buyers as well as the services of an Information Office. Special tickets for the Belgian State Railways are being issued at an inclusive charge for periods of five or fifteen days. Among the groups into which the Fair is to be divided are:—Electrical industries; metallurgy and mechanism; india-rubber and its applications; motor-cars, aviation, and cycles; building trades and architecture; and scientific instruments.

**The Dutch Electrical Industry.**—In Holland, as elsewhere, the competition exercised by countries with a depreciated currency is enlisting widespread concern among manufacturers. The Vereeniging van Fabrikenten op Electrotechnisch Gelied has lately taken steps to bring the subject under the notice of the Minister of Commerce. Addressing a communication to the Minister, the Association declares that the abnormal conditions at present prevailing render necessary the strict exaction of the percentage of protection fixed by the law—which is very low, being in general not more than 5 per cent.; this would avoid making it illusory by additions resulting from the disastrous condition of the exchange. The Association contends that the 5 per cent. import tax should be levied on the amounts of the invoices reckoned, not on the basis of the daily quotations, but on the intrinsic value of money in the country of origin, and this with special reference to Germany. Furthermore, in special cases the Association insists that the Minister should, if he thinks it needful, be endowed with special powers to forbid importations provisionally, since the general interests of the country cannot be served by the ruin of the Dutch electrical industry.

**Trade Conditions in Colombia.**—The Commercial Secretary to H.M. Legation at Bogota foretells a return to normal conditions in Colombian trade by about the end of next summer. He bases his opinion on the fact that Colombian merchants have been and still are buying few goods from abroad, and meanwhile are selling their coffee and other produce abroad at fairly good prices. There appears to be a disinclination on the part of most merchants to resume buying relations, maintained during the war, with United States firms; this is said to be due partly to American methods of business and partly to the quality of the merchandise supplied. There is a probable future market to be developed for agricultural machinery, tractors, motor vehicles and machine tools, and, dependent on the recovery in public finance, a considerable demand for railway material and rolling stock, railway and road bridges and road-making machinery. Medellin has adopted and started a definite plan for a street car system, and both Barranquill and Cartagena have considerably developed suburban building and roads, and have improved the water supply and drainage.

**Forthcoming Exhibitions.**—The following exhibitions are being organised :—

London.—March 1st to 25th, Ideal Home Exhibition; April 11th to 25th, Builders' Exhibition; May 1st to 6th, Photographic Fair; July 3rd to 14th, London Fair and Market.

Birmingham.—March 20th to May 13th, National Trades & Industrial Exhibition; May 25th to June 3rd, Industrial and Commercial Efficiency Exhibition; June 15th to 24th, International Foundry Trades Exhibition.

Cardiff.—May to October, Welsh National Exhibition.

Algeria (*Algiers*).—April 14th to May 16th, Exhibition-Fair.

Belgium (*Brussels*).—April 3rd to 19th, Commercial Fair.

Brazil (*Rio de Janeiro*).—September 7th to November 15th, Centenary Exhibition.

France (*Paris*).—April, Heating Apparatus Exhibition.

Italy (*Milan*).—April 12th to 27th, International Sample Fair.

Norway (*Christiania*).—April 22nd to May 7th, Electrical Exhibition.

Switzerland (*Basle*).—April 22nd to May 2nd, Sample Fair.

Trieste.—May, International Sample Fair.

**Applications for British Trade-Marks.**—Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries :—

Parraynite. No. 419,438. Class 11. X-ray protection tube boxes, aprons, and screens.—Murray, Parkyn & Co., Vulcanite Engineering Works, Carrington Field Street, Stockport. October 11th, 1921.

Ignota (lettering and design). No. 419,574. Class 50. Electrical insulating compositions.—Ernest Child, trading as E. Child & Co., 16, Mincing Lane, London, E.C. October 15th, 1921.

Champion. No. 420,526. Class 13. Sparking plugs.—Champion Spark Plug Co. of Canada, Ltd., 1416, Howard Avenue, Windsor, Ont. October 14th, 1921.

Electricalities. No. 417,959. Class 13. Cast-iron watertight electric light fittings, electric brackets, lanterns, &c.—The Cable Accessories Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs. August 25th, 1921.

Eutherme. No. 414,022. Class 18. Electric cooking and heating apparatus. April 6th, 1921. No. 419,950. Class 13. Electric cooking utensils and electric irons.—"Therma" Fabrique d'Appareils de Chauffage Electrique, Schwanden, Switzerland. October 27th, 1921.

**Russia's Electrification.**—The chairman of the Soviet Electrification Commission states that the Government proposes to place before the Genoa conference a scheme for the participation of foreign capital in the future electrification of the whole of Russia, by means of the establishment of a bank in Russia with the assistance of foreign capitalists. A period of 20 years is fixed for the execution of the work, the first instalment representing an expenditure of 2,000,000,000 gold roubles.

**Proposed International Exhibition.**—Official Disclaimer.—With reference to a statement which has appeared in the Press to the effect that an International Exhibition will be held in 1924 at the White City, with the "moral" support of the Government, we are informed by the Exhibitions Division of the Department of Overseas Trade that it has received no information whatever of this project up to date.

**Trade Conditions in Peru.**—Prosperous years have increased the importance of Peru and left it basically in a far stronger position than it was before the war. Such is the opinion expressed by H.M. Consul at Callao, Commercial Secretary at Lima, in a report which has just been issued by the Department of Overseas Trade. Its improved position is due to the opening of the Panama Canal and the subsequent demand for Peru's chief products, viz., copper, sugar and cotton. The country was naturally affected by the slump which has occurred in international trade, but the effects of this are gradually passing away. Admittedly the financial position of the Government is by no means favourable, and it intends to remedy the position by a foreign loan on the one hand and the imposition of an income tax on the other. Though Peru is primarily an exporter of raw materials and an importer of manufactured goods, she has established during the past few years a number of factories, *e.g.*, cotton spinning and weaving mills, tanneries, iron foundries, and breweries. The Commercial Secretary considers that possibilities lie before a glass works, an earthenware factory, a wood alcohol distillery, a sack-making plant and a paper works. The Peruvian Government is anxious further to develop the mineral resources of the country. United States capital is already largely interested in copper mining. The report states that it is still profitable to mine and ship silver, but that the prospects of winning gold are not encouraging. Petroleum exploitation seems to be hampered by taxation and the lack of a definite legislative policy. American competition in the supply of imported goods naturally gained strength during the war, and is likely to be fairly well maintained on account of the capital from the United States which is invested in the country. German metal goods and machinery are also appearing again, favoured by the exchange.

**Patent Applications.**—Applications have been made for the restoration of the following patents :—No. 18,278, of 1908, for "Improvements in the process of sealing the filament carrier into the bulb of electric incandescent lamps," granted to Johann Kremenezky. No. 1,453, of 1915, for "Mercury globule electrical contact maker for releasing mine winding, signal indicators, actuating indicators of the stopping, starting, and reductions of speed of machinery and the like," granted to George Saint.

**Lead.**—Reporting under date February 4th, Messrs. James Forster & Co. state that on February 3rd closing prices were £21 5s. for all positions, against £23 2s. 6d. for January and £23 for April a week previously. The difficulty of disposing of arrived lead—the total for the month of January being greatly in excess of previous months—had much to do with the drop in values, but it had been assisted by heavy "bear" selling forward. "The consuming trades continue slack, and most consumers have sufficient stocks to carry on with. A fair quantity has recently gone into warehouse, and supplies in prospect at present for February arrival appear to be ample."

**New Italian Company.**—A company has recently been formed under the title of the Società Anonima F.A.T.M.E., capitalised at 5,000,000 lire to manufacture telephone apparatus and other electrical material in Italy. Situated just outside Rome, the company's plant promises to become fully occupied at no distant date, the avowed object being the freeing of Italy from the monopoly enjoyed by foreign firms with regard to this class of electrical material.—*Reuter's Trade Service.*

**"Lektrik" Lighting Connections.**—This well-known and useful little work has now reached its eightieth thousand by the issue of a seventh edition. The explanations of circuits have been revised to make comprehension still easier, and a number of new arrangements appear. Although the value of Messrs. Lundberg's "switching certificates" was recently queried by a correspondent (but subsequently testified to by another), there is no doubt as to the value of the information given in this booklet. The work may be obtained from Messrs. A. P. Lundberg & Sons, Pioneer Electrical Works, 477-489, Liverpool Road, N.7. Price 1s. net.

**German Grip on Swiss Industry.**—In our last issue we published a paragraph under this title, on the authority of the correspondent of *The Times* at Geneva. In its issue of February 3rd *The Times* published the following further dispatch from its correspondent at Geneva, which we have pleasure in publishing :—

"In a recent article on the German grip on Swiss industry it was stated that Swiss industry was becoming absorbed by the German 'Holding' syndicates. In many cases this is true, but from later and more accurate information in regard to the firm of Sulzer & Co., Winterthur, one learns that its capital is in Swiss hands, and that it has created in many countries seats in which Swiss money is invested."

**The German Glow Lamp Trust.**—A great augmentation in the capital of the German glow lamp trust is on the point of being carried into effect, the object of which is such as to command attention in wide circles outside that country. When a few years ago the glow lamp department of the German Incandescent Gas Light (Auer) Co. was separated from this company and combined with the similar departments of the Siemens & Halske Co. and of the A.E.G., the amalgamated undertaking assumed the title of the Osram Works, Ltd., or that of a private or partnership company, which thus escapes the tax on joint stock company shares and is not under any obligation to publish its accounts. The three partners are Koppel & Co. (Auer interests), the Siemens & Halske Co., and the A.E.G.. and they fixed the ordinary partnership capital at 60,000,000 marks, deciding to provide additional funds by the issue of bonds, of which two series of the 4½ and 5 per cent. types respectively have raised a total of 120,000,000 marks. Now the proprietary companies have sprung a surprise on the financial public by deciding to make a further emission of 300,000,000 marks in bonds of the Osram Co. all at one time for the purpose, according to the official statement, of strengthening the working capital, and particularly for the further development of the foreign organisation. The new issue is of interest not only from the latter point of view, but also from that of the form given to the new bonds or non-mortgage debentures. Unofficially it is stated that the proceeds of the new loan are substantially required for the reconstruction of the former foreign organisations of the individual companies forming the partnership. It is not obvious from this statement whether it refers solely to the export lamp trade or to the general export trade of the two electrical companies in question. The new loan takes the form of profit bonds bearing a fixed rate of 5 per cent. and capable of rising to a maximum of 10 per cent., thus endeavouring to meet the wishes of the public for a security offering a high rate of interest. The increase over 5 per cent. will take the form of the holders of the bonds receiving a bonus at the rate of ⅛ per cent. for every one per cent. or portion of one per cent. by which the average dividend on the ordinary shares in the A.E.G. and the Siemens & Halske Co. exceeds 10 per cent. These two firms have guaranteed the redemption of the loan within 50 years at a pre-arranged premium, and also the payment of the bonus on the profit bonds. A banking syndicate has taken over 120,000,000 marks of the new loan, and proposes to offer it for subscription at the price of 125 per cent., while the balance of 180,000,000 marks will probably pass into "firm hands."

The scheme represents an entirely new departure in the flotation of capital in Germany, on a large scale, although there is no doubt that it will be successfully carried into effect, as it has the financial guarantee of two of the principal manufacturing companies behind it.

**Portuguese East Africa and the Union.**—A feature of Portuguese East African trade, which is noted in the recently-issued report by H.M. Consul-General at Lourenço Marques, is the entry of the Union of South Africa into the market as a competitor in engineering contracts. An example of this is a large coaling plant, now ready at Johannesburg, for erection at the Port of Lourenço Marques, the whole of which, with the exception of two electric motors supplied from England, has been manufactured in the Transvaal from material of local production. The competition of the United States of America is also evident, particularly in hardware and machinery. Yet up to the present time the United Kingdom is easily first as supplier of manufactured goods to Portuguese East Africa, particularly in machinery and hardware. The rivalry of Germany has also to be considered; low prices and not too inferior quality, says the Consul-General, give her goods a great advantage over those of the United Kingdom. He adds, however, that where Portuguese products come into competition with British products, as, for example, in hardware, the British are so far superior that the competition is hardly felt. There are a few industrial developments which are of interest in connection with future trade in engineering products, but it must be borne in mind that currency difficulties will have to be removed before import trade can revive. Sugar manufacture is still on the increase. Furniture-making is developing at Lourenço Marques, excellent hardwoods being in abundant supply. A cement factory and cold storage have been started near the port. Much irrigation work is contemplated.

**The South African Railway Contract.**—A Bloemfontein dispatch to the Paris *Daily Mail* states:—"The Union of South Africa's acceptance of the tender of the Metropolitan-Vickers Electrical Co., Manchester, for locomotives for South African electrified railways will be the subject of a Nationalist attack on the Government when Parliament meets in February. It is alleged that the German tender was £5,000 per locomotive less . . . while the tender included a stipulation for payment in raw materials like hides, wool, mealies, and the like—an appeal to South African farmers."

**The White City Electrical Plant.**—The War Compensation Court has awarded the Shepherd's Bush Exhibition Co. £326,758 in respect of its claim of £1,250,000 for re-instatement occupation, &c., in connection with the military occupation of the White City. One of the claims was for damage to the electrical plant, originally estimated at £16,237, then revised to £8,486; in respect of this item £2,930 is the amount of the award now given.

**Receivers Appointed.**—Swift Electrical, Ltd.—Louisa Butler, of 94, Woodlands Gardens, N.10, was appointed receiver and manager on January 21st, 1922, under powers contained in debenture dated October 18th, 1921.

Rushmores (1919), Ltd.—Sir Basil E. Mayhew, K.B.E., of 20, Alderman's House, E.C., was appointed as receiver on January 27th, 1922, under powers contained in debentures dated November 30th, 1920.

**The Danish Tariff.**—The Danish Customs authorities have recently given a decision to the effect that "mica rings used as insulating material in electrical apparatus" when imported into Denmark are to be classified under heading No. 78 of the Tariff, the duty being 0.2 öre per kilogramme.

**Dangers of Acetylene Gas.**—The Factory Department of the Home Office has issued a "Memorandum on Dangers from the Use of Acetylene Gas and in Oxy-Acetylene Welding in Factories" (Form 1,704. H.M. Stationery Office. Price 1d. net). This gives in a concise manner the numerous ways in which explosions may be caused, and for each of these ways the precautions to be taken are set forth. It is stated that the lighting of acetylene generator houses should be carried out by means of incandescent electric lamps encased in outer gas-tight glass globes. Electrical switches, fuses, &c., in a generator house or near a generator should be so constructed that risk due to sparking or fusing in an explosive atmosphere is avoided.

**New Indian Company.**—The British Arc Welding Co. (India) is the name of a new concern which has lately been formed in Calcutta (16, Strand Road), with a capital of 250,000 rupees, to carry on an electric welding business.

**A French Amalgamation.**—The shareholders in the Etablissements Maljournal et Bourron, of Lyons, have just approved in extraordinary general meeting a scheme of amalgamation with the Société des Ateliers de Constructions Electriques et du Dauphiné of the same city. The chairman of the former stated that the combined undertaking would be able to produce everything from small electrical apparatus to machines of large powers.

**Chinese Note.**—The Shachi Electric Light Co. at Shachi has been granted registration by the Ministry of Communications.

**For Sale.**—Mr. C. W. Laycock (instructed by the Elland U.D.C.) will sell by auction on February 22nd, at the electricity works, the whole of the electricity plant, &c.

By direction of the Disposal Board. Offers are invited for surplus engine room plant at Liverpool Head Post Office. (See our advertisement pages to-day.)

## LIGHTING AND POWER NOTES.

**Accrington.**—Proposed Showroom.—The Electricity Committee has under consideration a suggestion to open a showroom for electrical fittings and appliances, in conjunction with the electrical tradesmen of the district.

**Argentina.**—Electrical Development.—According to *La Energia Electrica*, there exists in Argentina some 350 power stations and 80 sub-stations; 9 generating and 32 sub-stations are located in Buenos Ayres.

The Falls of Iguazu are being developed, and cataracts larger than those of Niagara, situated on the Upper Parana, on the Brazilian frontier, are to be utilised, as are also those on the River Uruguay, a little above Concordia. Surveys for the development of these water resources have already been made.

**Bexley.**—Lighting in Houses.—The whole of the houses on the Welling estate are to be wired for electric lighting, and the cost per house chargeable to the scheme is not to exceed £6.

**Blackpool.**—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £220,000 for new generating plant, mains, &c., for the electricity undertaking.

**Bradford.**—Loan.—Application has been made to the Electricity Commissioners for sanction to borrow £13,960 for the installation of additional plant in the electricity works.

**Burnley.**—Proposed Sub-station.—The electrical engineer of the electricity undertaking has been instructed to prepare a report showing the estimated cost of erecting a sub-station for the Rosegrove and Lowerhouse districts, and the estimated demand for electricity in these districts.

**Crewe.**—Loan.—The Town Council has applied for a loan of £10,000 for additional plant at the power station and for cables.

**Canada.**—Ontario.—The extent to which electricity is used in the province of Ontario is indicated in a list published in in a recent issue of the *Bulletin* of the Hydro-Electric Power Commission. This shows that the number of distributing municipalities in the various systems is as follows: Niagara

system, 144 (population 1,191,736); Severn system, 19 (41,552); Wasdell's system, 11 (11,150); Nipissing system, 4 (11,423); Muskoka system, 2 (3,597); Eugenia system, 28 (39,571); Ottawa system, 1 (107,732); Thunder Bay system, 1 (15,094); Central Ontario system, 37 (134,552); St. Lawrence system, 11 (15,660); Rideau system, 5 (16,260); Essex County system, 7 (11,017); Thorold system, 1 (5,012); making a total of 271 municipalities, covering a total population of 1,604,356.

**Continental.**—Jugo-Slavia.—The Commercial Secretary to His Majesty's Legation at Belgrade reports that the Zagreb journal *Agramer Tagblatt* has published an article concerning the formation of a syndicate for the development of hydro-electric power schemes which will be supported by the State. The first step to be taken is the erection, near Modric, of a water-power station of 8,000 h.p. capacity and the construction of another station on the lower Drina between Koviljaca and Janje of 29,000 h.p. The projected power stations are intended to provide electrical energy for Posavina, Podrinje, Slavonia, Syrmia, Backa, Djakovstina, and Osijek, and will be connected with the overland electrical system which the State contemplates, and it is also intended to connect these systems, via Zagreb, with the power system of Fala, so that the project of the central Government to provide an organised network of electric power lines in an east-to-west direction can be accomplished without great delay.

Italy.—A scheme has been put into operation for the distribution of electrical energy from Switzerland to various power stations in the Lombardy plain. Part of the supply will pass through the French mine areas of Nancy and Vencey, a distance of over 400 miles.

On the River Sila, in the Province of Catanzaro, a hydro-electric plant is being constructed by the Società per la Forze Idrauliche della Sila, with Government aid. The company has contracted bank loans to the extent of 200 million lire. This is a preliminary to the raising of further capital until at least 500 million lire has been secured. It is intended to make use of the natural topography of the place in executing the project. Besides being situated at an altitude of some 1,235 metres above the level of the sea, the district is furnished with several natural basins. These, after work has been completed, will form immense reservoirs, with two falls of 597 and 405 metres. Work has commenced on the larger reservoirs. Various groups of turbines have been planned, the first of 67,227 h.p.; the second of 80,960 h.p.; and the third of 20,080 h.p.; making a total of 168,267 h.p. The total quantity of water to be impounded by the various reservoirs is estimated at 250 million cu. metres, and the total electric energy which will be generated is estimated at 800 million kWh per annum. —*Reuter's Trade Service* (Rome).

Germany.—The strike of the Berlin municipal employés has completely paralysed the gas, water, and electricity supply, and also the tramway traffic. The hospitals are without water and light. There has been no abatement of the railway strike, which has extended to the whole of Baden. The negotiations opened for the purpose of ending the railway strike have produced no result. The city is now almost without coal. A great number of factories and bakeries have been obliged to reduce their working hours. Some have already closed down. The strike practically ended on February 7th.—*Reuter* (Berlin).

France.—The effects of the drought during the past year are still felt in the Isère region by the growing scarcity of electricity. The Berges company, which has been supplementing the city's supply from its reserve steam plant, has now been forced to considerably reduce its supplies. The stations are unable to meet industrial needs and a complete stoppage is feared. On December 26th power was withdrawn for two days a week. Later the supply was limited to eight hours a day to authorised factories. Only bakers and daily papers were allowed to use electricity during the night. Prices have greatly advanced, being 0.40 fr. per kilowatt-hour for motive power, heating, and industrial purposes, instead of 0.15 fr.—*L'Industrie Electrique*.

The application for a 60-year concession for the establishment of a water-power station on the River Bave, at Bousselargues, made by the Omnium Régional d'Electricité, of Lempdes, Lower Loire, is now under official investigation. The station is intended to reinforce the Lempdes station of that company. The works projected include the formation of a dam and a 30-metre high reservoir, with accessory conduits to the station itself. The height of the fall will be 188 metres, and the scheme is estimated to yield 3,150 kW. The scheme is to be carried out in two stages.

**Coventry.**—Electricity Charges.—The City Council has considered a report from the Electricity Committee that a petition has been received from leading manufacturers regarding the charges for electrical energy, and stating that existing circumstances warrant a substantial reduction for the current quarter in the coal percentage of 50 per cent. and the "over-all" percentage of 40 per cent., applicable to consumers taking electrical energy on this system. It was resolved to reply that there was little prospect of a substantial reduction during the December quarter, but that there would be a reduction for the March quarter, such reduction being made automatically with the decreased cost of coal.

**Derby.**—Loans.—The Electricity Committee has recommended the Town Council to apply to the Electricity Commissioners for sanction to the borrowing of £70,000 for mains, and £20,000 for the purchase of motors and transformers.

**Egham.**—Extension of Area of Supply.—The Egham and Staines Electricity Co. is applying to the Electricity Commissioners for powers to extend its area of supply to include the parishes of Ashford and St. Anwell, Wraysbury, and Thorpe.

**Greetland.**—Electricity Supply.—Owing to complaints which have been made with regard to lighting the Council has approached the Electrical Distribution of Yorkshire, Ltd., as to the terms on which the company would be prepared to supply electricity to the district.

**Gloucester.**—Loan.—Application has been made to the Electricity Commissioners for sanction to borrow £47,000 for extensions to the electricity works, and for additional boilers, generating plant, &c.

**Inverness.**—Hydro-Electric Scheme.—At a meeting of the Town Council, on January 30th, the hydro-electric scheme was again discussed. A letter from the Trade Facilities Advisory Committee was read. This signified the Committee's favourable consideration of the question of guaranteeing debentures for £200,000 provided the following conditions were met: (1) That a company be formed with an ordinary paid-up share capital of £200,000; (2) that the scheme be approved by the Electricity Commissioners; and (3) that the scheme cost no more than £400,000. It was stated that Messrs. Armstrong, Whitworth & Co., Ltd., were willing to form a company and promote a Parliamentary Bill, and also to re-imburse the Corporation's expenses if the company was formed. It was finally decided to proceed with the survey, which was estimated to cost £200.

**Leeds.**—Loan Sanctioned.—The Corporation has received sanction from the Electricity Commissioners to borrow £38,500 for overhead mains and services on the Meanwood, Hawksworth Wood, Wyther, and Harehills housing estates.

**Liverpool.**—Loan Sanctioned.—The Electricity Committee has received the sanction of the Electricity Commissioners to borrow £17,082 for the provision of mains and services and sub-station equipment in connection with new houses.

**London.**—Finchley.—Proposed Linking-up.—A scheme is on foot for the linking-up of the Finchley and Hornsey electricity undertakings. It is proposed to lay two mains capable of carrying 1,000 kW each, at a cost of £10,200, and application has been made to the Electricity Commissioners for sanction to borrow that amount.

**Manchester.**—Loan.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £100,000 for work on feeder mains and on distributing stations.

**Marlborough.**—Application for Revocation of Order.—The Town Council has decided to apply for the revocation of the Order obtained in 1913 by the Marlborough Electric Lighting Supply Co., Ltd., which has failed to carry out its obligations.

**Price Reductions.**—Charges for electricity have been reduced in the following districts: Croydon, Darwen, Dudley, Liverpool, Newcastle, Salford, Spenborough, and Stretford.

**Richmond (Surrey).**—Order Revoked.—The Electricity Commissioners have revoked the Richmond Electricity (Temporary Increase of Charges) Order, 1919, as from January 31st, 1922, but without prejudice to any rights and liabilities which might already have become due thereunder.

**Stone (Staffs.).**—Electricity Supply.—The Gas and Electricity Co. has informed the Urban District Council of its intention to put down electrical plant and exercise its powers under the Act of 1914. The company has applied for an extension of time to carry out the work, but the Electricity Commissioners have deferred their decision until the inquiry into the proposed formation of a Joint Electricity Authority for the North-West Midlands has been held.

**Tunbridge Wells.**—Loans.—The Town Council has decided to apply for a loan of £12,975 for expenditure on mains, services, transformers, a sub-station, and sub-station pillars, for the ensuing three years, and for £4,378 to cover the increased costs of the installation of the new turbo-alternator, condensing plant, pipework, and switchboard.

**Wicklow.**—Electricity Supply.—The Urban Council has directed the Town Clerk to procure information regarding a proposed electricity scheme.

**Wigan.**—Loan.—Application has been made to the Electricity Commissioners for sanction to borrow £49,720 for extensions to the electricity works.

## TRAMWAY AND RAILWAY NOTES.

**Black Country.**—Control of Tramways.—A Bill is being promoted in Parliament this session by the Birmingham District Power & Traction Co., Ltd.; the Dudley, Stourbridge and District Electric Traction Co.; the South Staffordshire Tramways Co.; the South Staffordshire Tramways (lessee) Co., Ltd.; and the Wolverhampton District Tramways, Ltd., in which it is proposed to postpone the right of purchase of the tramway undertakings by local authorities until within six months after September 29th, 1950. It is further provided that from the passing of the Act a joint committee shall be formed, entitled "The Birmingham and Midland Tramways Joint Committee," for the management of the undertakings of the five companies. This will include three persons appointed by the directors of the Birmingham District Power and Traction Co., Ltd., and two persons appointed by each of the other four companies. It is also proposed to raise the fares on all the tramways and light railways to 1½d. per mile, with a minimum of 2d. a passenger.

**Blackpool.**—Tramway Profits.—At a recent meeting of the Town Council it was reported that during the past ten years the net profit of the tramway undertaking had been £118,000, of which £94,000 had been applied to the relief of the rates.

**Bradford.**—Loan.—Application has been made to the Ministry of Transport for sanction to borrow £36,250 for track renewals.

**Doncaster.** — Proposed New Route.—The Ministry of Transport recently held an inquiry at Doncaster into the application of the Corporation to borrow £10,000 for improvements to the tramway system. It is proposed to lay a track along Factory Lane and Trafford Street at an estimated cost of £4,430, in order to provide a circular route for the Bentley and Brodsworth cars, and so abolish the present terminus in Frenchgate. Other improvements include the relaying and doubling of a part of the track in St. Sepulchre Gate and Baxtergate at an estimated cost of over £5,000.

**Continental.**—Germany.—The arrangements for 1922 for the extension of the German electric railway network are as follows: The existing electrified section of Königszelt-Halbstadt-Liebau is to be extended to embrace Hirschberg-Görlitz-Schreiberhau and Grünthal, 130 km. in extent. In the middle German brown coalfields the Leipzig to Schönefield line is to be extended to Engelsdorf, Bitterfeld, and Magdeburg, a distance of 130 km. In the three following years it is intended to open for working a series of sections in Bavaria, namely, Münich to Garmisch, in 1923; Münich to Regensburg, in 1924; and Münich to Salzburg and Kufstein, in 1925. The works hitherto carried out in the electric working of the main lines has made clear the kind of locomotives needed. A special type has been evolved for express, passenger and goods trains for travelling on the flat; and another, suited for each class of traction for travelling in hilly districts. A settlement as to the system to be employed has also been arrived at, a.c. being retained for long-distance traffic, while d.c. is chosen for short-distance traffic in and around Berlin. Normalisation has been effected as far as possible in track equipment and other constructive details. Hand in hand with the electrification of the country's network has gone the construction of the big power stations and accessory installations for the generation and distribution of electricity. The great Walchensee power station on the Isar is expected to be finished in 1923.

**Halifax.**—Proposed Extensions Rejected.—The Town Council has rejected the Tramways Committee's scheme to extend the tramways, by single track, from Skircoat Green terminus to Dudwell Lane, on the ground that the extension would not bring in sufficient revenue.

**Hull.**—Proposed Extension of Tramways.—The City Council has approved application being made to the Ministry of Transport for power to extend the tramways to Hessle, at an estimated capital cost of £36,000.

**Liverpool.**—New Track.—The City Council has decided to construct a double tramway track along Belvidere and Devonshire Roads, at an estimated cost of £38,213.

Fares.—The City Council has decided to seek powers to continue the two-penny minimum fare on the tramways for another year.

**London.**—The report of the directors of the London, Brighton & South Coast Railway states that it is proposed to complete the suburban scheme of railway electrification which was interrupted by the war as soon as financial and other conditions permit. With a view to providing funds to carry out the works immediately in contemplation, steps were taken to apply for additional capital powers, but for certain reasons it is not proposed to proceed with this application.

Railless Car.—The South Metropolitan Electric Tramways Co. has recently carried out an experiment with a railless car on the steep incline from Anerley to the Crystal Palace.

**Sunderland.**—Strike.—The employés of the District Tramways Co. have struck work as a protest against a proposed reduction of wages, and the system is at a standstill.

## TELEGRAPH AND TELEPHONE NOTES.

**Australia.**—Telephone Extensions.—The Postmaster-General proposes to ask Parliament next Session to sanction a loan for £8,000,000 to improve and expand the telephone system throughout Australia and to build trunk lines. His idea is to adopt a continuous scheme, which will be independent for three or four years of the annual Parliamentary votes. There are now 12,000 unsatisfied applications in the principal cities for telephone connection, besides thousands in the country districts for communication with the main systems. The Cabinet has made available £200,000 as a first instalment, says *The Times*.

Automatic Exchanges.—The construction of automatic telephone exchanges at Ascot Vale (Vic.), estimated to cost £85,826, and at North Melbourne, estimated to cost £97,226, has been formally sanctioned by the House of Representatives.—*Industrial Australian and Mining Standard.*

**Barbados.**—New Cable.—The officials of the Western Union Telegraph Co. state that they expect a licence will be issued shortly for the landing of the Barbados cable at Miami. —*Reuter's Trade Service* (Washington).

**Ex-German Pacific Cables.**—Final Disposition.—The former German cables in the Pacific Ocean that centred about the island of Yap were allocated on December 31st, 1921, and a complete agreement affecting their joint use for commercial purposes without restrictions was reached by representatives of the six Powers involved. The cables have been sealed since Japan seized the German islands, early in 1914; in most instances the tentative approval given must be confirmed by the home governments. The cables awarded are: Yap-Guam cable to the United States. Yap-Shanghai cable to Japan. Yap-Menado cable to Holland. The company was not entirely German, but a combination of German and Dutch, the Dutch investors holding about one-third, roughly, of the stock and bonds of the corporation which owned the cables. In addition, the important line from Yap to Menado, on the island of Celebes, terminated in Dutch territory. Both of these complications were avoided by giving Holland, in full satisfaction of her claims, the cable from Yap to Menado. The cable from Yap to Shanghai had been diverted by the Japanese soon after their seizure of the Marshall and Caroline Islands to a Japanese port. They are willing to construct a link to re-establish the line to Shanghai. The third cable, that from Yap to Guam, had already, under the agreement reached since the convening of the conference between the Japanese and Americans, been assignd to the U.S.A., and a treaty drafted setting forth the American rights in the island of Yap. Six nations were represented at the conference on December 31st—the United States, Great Britain, Japan, France, Italy, and Holland. The decision was "without prejudice" to the decision to be reached later as to the German cables in the Atlantic.—*T. and T. Age.*

**Paraguay.**—Telegraph Extensions.—The work of extending the network of State telegraphs will begin very shortly, including the construction of new lines designed to link up the Paraguayan lines with those of Brazil.—*Financial News.*

**South Africa.**—Automatic Telephony.—An automatic telephone exchange is being established at Durban.—*British and S. African Export Gazette.*

## CONTRACTS OPEN AND CLOSED.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.)*

### OPEN.

**Accrington.**—Corporation. 25,000-lb. water-tube boilers, economisers, and brick work. (February 3rd.)

**Ashton-under-Lyme.**—February 22nd. Electricity Committee. Circulating water pipes and valves and exhaust steam pipes. (February 3rd.)

**Australia.**—Melbourne.—April 29th. Victorian Electricity Commissioners.—31 miles .15 sq. in. 3-core power cable and 20 miles, .007 pilot cable, with accessories, for a 22,000-V circuit. —*Reuter's Trade Service* (Melbourne).

April 5th. Commonwealth P.M.G. Telegraph condensers. (Sched. 613.)

April 19th. Telegraph and testing instruments. (Sched. 549.) (See this issue.)

Adelaide.—April 5th. P.M.G.'s Department. Twelve adjustable condensers for use on telegraph duplex circuits. (Sched. No. 613.)*

Brisbane.—April 19th. P.M.G.'s Department. Testing and telegraph instruments. (Stores Sched. No. 549.)*

**Aylesbury.**—Electricity Department. One 1,500-kW or alternatively one 1,000-kW turbo-alternator, condenser, and switchgear. (February 3rd.)

**Belfast.**—February 28th. Tramways Committee. Six or 12 months' supply of tramway stores, including electrical accessories, cable, lamps, &c. (See this issue.)

**Bulgaria.**—March 21st. Bulgarian Postal Authorities. Telephone pole-line hardware (four pin carriers for insulators, bolts, &c.).*

March 28th. 3,000 junction pieces for batteries, &c.*

**Burton-on-Trent.**—February 22nd. Electricity Department. One 6,000-kW turbo-alternator with condenser and switchgear. Two 40,000-lb. water-tube boilers complete with economisers, coal-handling plant, bunkers, buildings, and chimneys. (February 3rd.)

**Dundee.**—February 27th. Electricity Department. Five sets of converting machinery. Mr. H. Richardson, general manager and engineer.

**East Grinstead.**—February 24th. U.D.C. Two-stroke oil engine-driven generators and other plant and electrical equipment. (February 3rd.)

**Edinburgh.**—February 15th. Electricity Supply Department. Auxiliary circuits and electric lighting and earthing, for Westbank power station. (Spec. No. 34.) (January 27th.)

**Eston.**—February 28th. Urban District Council. Overhead lines, underground cables, transformers, sub-station equipment, and public lighting fittings. (January 27th.)

**Gloucester.**—February 14th. Electricity Department. Two 1,500-kW turbo-alternators with condensing plant. (February 3rd.)

**India.**—Calcutta.—March 20th. Municipal Council. Eight electric lorries and motor-generator charging set. Particulars from chief engineer to the Corporation.—*Reuter's Trade Service* (Calcutta).

**London.**—February 13th. L.C.C. 2,500 or alternatively 4,500 tons of standard steel girder tramway track rails with fishplates. Chief Engineer, 19, Charing Cross Road, W.C.2.

Hammersmith.—February 22nd. Electricity Department. Stores for three, six, or twelve months. (February 3rd.)

Paddington.—February 20th. G.W.R. Three months' supply of electrical and telegraph stores. (February 3rd.)

**Manchester.**—February 14th. Tramways Committee. General stores, &c. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

February 21st. Electricity Committee. C.I. water tanks and accessories. (Spec. B27.) February 27th. L.p. valves, cocks, &c. (Spec. B28.) L.p. pipework for auxiliary services (B29). (See this issue.)

**Oldbury.**—February 18th. U.D.C. Electric light installation, public buildings and library. Mr. R. Fletcher, surveyor.

**South Africa.**—Durban.—April 12th. Corporation Electricity Department. Two 500-kW rotary converter sub-station equipments or alternatively mercury arc rectifiers with automatic switchgear.*

Grahamstown (C.P.).—According to the *British and South African Gazette*, tenders for the electric lighting scheme (£65,000) will be called for about June or July next.

**Skipton.** — February 25th. Electricity Department. Supply, laying, and jointing l.p. 4-core paper-insulated lead-covered steel-tape armoured cable. (February 3rd.)

**Swansea.**—February 17th. Swansea Harbour Trustees. One 3-phase, 400-kVA transformer. (See this issue.)

**Wolverhampton.**—Electricity Department. Two water-tube boilers and integral superheaters. (February 3rd.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

## CLOSED.

**Ayrshire.**—Education Committee.

Electric light installation, St. Margaret's School.—W. G. Dodd, Ayr.

**Glasgow.**—Corporation. Recommended:—

Electric lighting installation in the Corporation houses at Craigton, £3,770.—D. & J. Gilmour.
Steelwork foundation for turbo-generator at Pinkston.—P. & W. MacLellan, Ltd.
Clevis strain insulators.—Fleming, Birkby & Goodall, Ltd.
Single-stroke bells.—Standard Electric Co., Ltd.
Cable.—Western Electric Co., Ltd.

Accepted:—

One electric locomotive for Provan Gas Works.—Electric Vehicles, Ltd.
One electric locomotive and generator set.—Electric Locomotive and Foundry Co., Ltd.

**London.**—Fulham.—Electricity and Lighting Committee. Recommended:—

Additions to the generating station, Townmead Road, £5,565.—W. Moss and Sons.

**Sunderland.**—Corporation. Accepted:—

Cables.—Brit. Ins. & Helsby Cables, Ltd.
Capping.—Armstrong, Addison & Co.
H.p. steam pipes.—Babcock & Wilcox, Ltd.

**The Hague.**—Mr. S. Utting, London, has received the order for the equipment of two large Babcock C.T.M.-type boilers at the Hague electricity works. The Prat draught system is to be installed, and the air heaters are to be of the "Thermix" type. This order makes the fourth installation for this important electricity works.

**Worthing.**—Electricity Committee. Recommended:—

One 500-b.h.p. Diesel engine with 345/350-kW generator (£11,739).—Mirrlees, Bickerton & Day, Ltd.
Cables (£1,591).—Enfield Ediswan Cable Works, Ltd.

## FORTHCOMING EVENTS.

**Electro-Harmonic Society.**—Friday, February 10th. At the Great Hall, Cannon Street Hotel, E.C. At 8 p.m. Ladies' night.

**Birmingham and District Electric Club.**—Saturday, February 11th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Illumination from the User's Point of View," by Mr. C. G. A. MacDonald.

**Electrical Contractors' Association (London Branch).**—Tuesday, February 14th. At the Engineers' Club. At 8 p.m. Smoking concert and conference.

**Industrial League and Council.**—Wednesday, February 15th. At Caxton Hall, Westminster, S.W. At 7.30 p.m. Lecture on "Industry and its Relation to Finance," by Sir Geo. Paish.

**Nottingham Society of Engineers.**—Wednesday, February 15th. At the Welbeck Hotel. At 7 p.m. Paper on "Super-heated Steam: Its Developments and Utility," by Mr. F. O. Bynoe.

**Institution of Railway Signal Engineers.**—Wednesday, February 15th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 3 p.m. Annual general meeting. Presidential address.

**Institution of Electrical Engineers.**—Thursday, February 16th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Rotary Converters, with Special Reference to Railway Electrification," by Mr. F. P. Whitaker.

Informal Meeting.—Monday, February 13th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "The Evolution of a Staff Trade Union," to be opened by Mr. J. H. Parker.

**(North-Eastern Centre).**—Monday, February 13th. At the Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Rotary Converters," by Mr. F. P. Whitaker.

**(North Midland Centre).**—Tuesday, February 14th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Paper on "The Cyc-Arc Process," by Messrs. L. J. Steele and H. Martin.

**(Scottish Centre).**—Tuesday, February 14th. At 207, Bath Street, Glasgow. At 7.30 p.m. Lecture on "The Use of Wireless, Past and Future," by Major J. Erskine-Murray, R.A.F.

**(Dundee Sub-Centre).**—Monday, February 13th. At University College, Dundee. At 7.30 p.m. Paper on "Publicity and Electrical Development," by Mr. J. W. Beauchamp.

**(East-Midland Sub-Centre).**—Tuesday, February 14th. At the Loughborough College. At 6.45 p.m. Informal address on "High-power Mercury Arc Rectifiers," by Mr. R. L. Morrison.

**(North-Western Students' Centre).**—Tuesday, February 14th. At the Houldsworth Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "Hydro-Electric Power Supply," by Mr. A. Tustin.

**Chelmsford Engineering Society.**—Thursday, February 16th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "High-speed Wireless Telegraphy," by Mr. C. H. Ford.

**Northampton Engineering College Engineering Society.**—Thursday, February 16th. At the Northampton Institute, St. John Street, E.C. At 5.30 p.m. Paper on "Electric Lifting Magnets: their Use and Construction for Steel Works," by Mr. J. B. Kramer.

**Chemical Society.**—Thursday, February 16th. At Burlington House, Piccadilly, W. At 8 p.m. Ordinary scientific meeting.

**Electrical Development Association.**—Friday, February 17th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7.30 p.m. Discussion on "Salesmanship in Relation to Electric Lighting," to be opened by Mr. H. T. Harrison.

**Institution of Mechanical Engineers.**—Friday, February 17th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "Electric Welding Applied to Steel Construction, with Special Reference to Ships," by Mr. A. T. Wall.

**London Electrical Engineers Old Comrades' Association.**—Friday, February 17th. At the Bridge House Hotel, London Bridge, S.E. At 7 p.m. Bohemian concert.

**Junior Institution of Engineers.**—Friday, February 17th. At Caxton Hall, S.W. At 8 p.m. Paper on "Water Purification for Boiler Feed Purposes," by Mr. W. J. Lenton.

## THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to inquiries received this week we need the names of suppliers or manufacturers of:—

Earle's Cement for commutator repairs.
Magnet Testphone for armature testing.
Omega insulating tapes.
Immersion Heaters of tubular form for total immersion in liquids (capacity 1 kW).
A periscopic arrangement for inspection of smoke from chimney shafts from a remote position.

## NOTES.

**Fatality.**—A fifteen-year-old boy, Albert Heeson, of Woodhouse Cliff, Leeds, employed in a bakehouse at Harehills, was killed on February 4th by contact with a live electric light wire. A temporary wire had been run into the basement, where a new oven was being installed, and the holder for the electric light bulb had become damaged. Heeson, it was supposed, was attempting to repair the holder with the electricity switched on, using a chisel without a handle for the purpose. He was heard to scream, and then he collapsed unconscious. A doctor was sent for, but on his arrival the boy was dead.—*Daily Dispatch.*

**The "C.S. Faraday."**—After being one of the most familiar sights in Thames shipping for nearly fifty years, the cable steamer *Faraday* has been condemned, and will be

broken up almost at once. She was built in 1874, and is of over 5,000 tons register. During her long life she has been all over the world in the service of her owners, Messrs. Siemens Bros., and has been one of the most successful vessels of her kind.—*Evening News.*

**Motor-'bus Repair Works at Chiswick.**—The London General Omnibus Company has opened at Chiswick a large central overhaul works where all repair work to the company's vehicles is now concentrated and standardised in one establishment, instead of in 30 or 40 garages scattered all over London. Some 2,000 persons are employed at the works, which occupies an area of 31 acres, 16 acres being under cover. With an organisation and equipment which are right up to date, the time required annually for motor-'bus overhaul is now reduced from 16 days to 4, which, of course, means a large reduction in the annual loss in the vehicle's working capacity. The factory is equipped on lines not hitherto attempted in this country for the rapid assembling of standardised units on a large scale, and the works will accommodate a weekly total of 100 units normally and 120 weekly during short rush periods. When a 'bus requiring overhaul enters the factory, the bolts holding the coach-work to the chassis are removed, and the former is lifted off by a multiple hydraulic jack; the chassis then leaves the shop for its own department, and an electric truck comes along to take the place of the chassis, and the body is carried away for stripping and reconditioning, painting, and so forth. In the process of dismantling the chassis, as this passes along the shop, it is stripped bit by bit of engine, clutch, gear-box, brakes, &c., down to the bare frame, the wheels themselves are taken into their special shop for re-tiring, and the springs are reheated in a double-ended reverberatory gas furnace. The washing of parts after dismantling is a considerable operation, both revealing weakness and signs of wear, and preparing the part for handling for repair purposes. As may be supposed, every variety of machine and tool are requisitioned at some stage or other of the work. The works are largely driven by electric power provided from the supply of the Underground Railways group, to which the L.G.O.C. belongs. The whole of the electric motors, totalling 1,300 h.p. (in sizes ranging from 5 h.p. to 80 h.p.), were provided by Messrs. C. J. Ferguson & Sons, of London, who carry very large stocks of motors. Practically the whole of the machines are standard shunt-wound enclosed, ventilated and open protected type, arranged for belt-driving. The starters are of the standard face plate type, and the machines are operated on a circuit of 550/600 volts. The electrical wiring and installation work was done by the L.G.O.C.'s own electrical staff. Each 'bus carries a dynamo for lighting supply, and the overhauling of these machines, as well as the wiring and other electrician's work in the 'buses themselves, has its proper place allotted to it in the efficient organisation of the various operations. A number of moving platforms are laid down on which repairs are carried out as the article under repair gradually moves on its way. Mr. G. J. Shave is the chief engineer and operating manager to the company, and he has under his control a fleet of 3,000 motor-'buses which are carrying 1,000 million passengers per annum, but these figures alone cannot convey an idea of the large extent of the engineering and other operations which are carried on in the Chiswick overhaul works, where what has been termed the "re-birth" of the motor omnibus takes place. It is stated that the works have cost £500,000, but the saving in the cost of maintenance will be £150,000 per annum.

**The Electro-Harmonic Society.**—At the concert (Ladies' Night) to be held to-night in the Great Hall, Cannon Street Hotel, Mr. Sidney Rentell will take the chair. The artistes will be as follows:—Miss Bessie Jones, soprano; Mr. Barrington Hooper, tenor; Mr. Edward Halland, baritone; Miss Gladys Millage, songs at the piano; Mr. Ernest Rutherford, concertina; Mr. Lloyd Shakespeare, cornet; Mr. W. V. Robinson, Canadian entertainer; Mr. Ernest Hastings, entertainer; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

**X-ray Cancer Research.**—The report of the Manchester Royal Infirmary states that the honorary radiologist received an anonymous offer of £4,000 to enable research to be carried out on a new method of intensive X-ray treatment of cancer, and a scheme has been drawn up, and a research scholarship in intensive-radio-therapy for the treatment of cancer has been instituted, says the *Evening Standard.*

Lord Atholstan has informed the Earl of Athlone, chairman of the Middlesex Hospital, that, in addition to his offer of £20,000 for the discovery of a medicinal cure for cancer, he will give another £20,000 in the meantime to help on the work of cancer research, says the *Daily Mail*, which also records that Sir William Veno, who in January offered £10,000 to supplement the offer by Lord Atholstan, has amended his proposal; he now promises to provide £1,000 annually for ten years in aid of cancer research. The payment of the money is, therefore, not dependent on a cure being found.

**Appointments Vacant.**—Sales Supt. (£500) for the Edinburgh Corporation Sales Department; engineering draughtsman for the Salford Corporation Electricity Department; wireless engineer-operator (£400+) for the Government of Trinidad; shift engineer (£440) for the Government of Nigeria, Electric Light Department; assistant mains and distribution engineer for the Wakefield Corporation Electricity Department; shift engineer for the Llandudno U.D.C. Electricity Department; Professorship and Head of the Department of Electrical Engineering in the City and Guilds (Engineering) College; chief electrical engineer for the Wimbledon Corporation. (See our advertisement pages to-day.)

**Lighting Large Stores.**—A rather serious drawback with various forms of flood-lighting projectors which have so far made their appearance is the difficulty in trying to vary the light distribution curve over sufficiently wide limits such as will ensure uniform lighting over any area that has to be treated. If, in certain cases, alteration in the focus has been made with the object of improvement in this direction the efficiency of the equipment has of necessity suffered in consequence. In many cases, also, the projectors have to

Exterior Holophane Lighting.

be placed fairly close to the building to be illuminated, with the result that the units generally employed do not possess sufficient covering power to ensure uniformity of illumination.

An installation worthy of notice in this direction is the lighting of Messrs. Alders' premises at Croydon, a photograph of which we are able to reproduce. The scheme was carried out by Messrs. J. & T. Robinson, electrical contractors, of Croydon, in collaboration with Messrs. Holophane, Ltd., of London.

The equipment comprises six units mounted in a trough and placed on each side of the building, equipped with 200-watt gasfilled lamps and Holophane-F.150 reflectors mounted horizontally, the angles and setting of which were carefully calculated and adhered to by the contractors. By changing the character of their distribution curve they are enabled to reproduce similar results from greater or lesser distances, thus meeting all requirements in this direction. A further feature worthy of mention is the few points necessary to achieve such results, and the energy consumption, *i.e.*, 2.4 units per hour, represents a very economical figure for this class of spectacular lighting.

**Electrified Seed.**—At a meeting of the Advisory Council of the Agricultural High School, Bendigo (Victoria), recently, the principal described some interesting experiments which were being made with electrified seed at the school. It was stated that oats electrically treated, and with ½ cwt. of superphosphate to the acre, gave six tons more green weight of oaten hay than an unmanured plot with unelectrified seed had returned. Plots treated with manure, but sown with unelectrified seed, gave lighter returns than where the two treatments were applied. One farmer who had sown ten acres with electrified seed had reported that his crop last season had averaged a bushel and a half to the acre more than the unelectrified seed had yielded.—*Industrial Australian and Mining Standard.*

**Educational.**—City and Guilds (Engineering) College.—After thirty-seven years' service in the college, following two years' service at the Finsbury Technical College, Professor T. Mather, F.R.S., is retiring at the end of the present session. Professor Mather succeeded to the Chair of Electrical Engineering on the death of Professor W. E. Ayrton, F.R.S., with whom he had been so closely associated in the organisation of the department. The City and Guilds (Engineering) College forms the Engineering Section of the Imperial College of Science and Technology, under the Delegacy representing the Imperial College, the City and Guilds of London Institute, and the Goldsmiths' Company.

The Delegacy will proceed shortly to consider the appointment of a successor to Professor Mather, and is inviting applications.

Faraday House Scholarships.—The annual examinations for a Faraday scholarship of fifty guineas per annum tenable for two years in college and one year in manufacturing works, and for a Maxwell scholarship of fifty guineas per annum tenable for one year in college and one year in works, will be held at Faraday House on April 11th, 12th, and 13th, 1922. Exhibitions may also be awarded to candidates who acquit themselves creditably in these examinations. Full particulars may be obtained from the Secretary, Faraday House, 62-70, Southampton Row, London, W.C.1.

**An Electrically-driven Winder.**—Referring to the article appearing in our issue of January 27th under this heading, it should have been stated that the main contractors for this interesting installation were the British Westinghouse Electric and Manufacturing Co., Ltd.

**Electric Motors for Washing and Sewing Machines.**—Referring to the case reported in our "Legal" column on Jan. 27th, Mr. S. J. Sewell, of 27, Chancery Lane, W.C., writes:—"I have been for some years of opinion that it is essential that washing and sewing machines should be driven by fractional-h.p. electric motors, and have in my *Sewing and Washing Machines Gazette* preached that reform, but the action against Harrods, which was a claim for damage to the fingers of a lady in the wringer used as an adjunct to the 'Thor' washing machine, is, I fear, likely to give a 'set-back' to electric washers and also to electrically driven sewing machines. I should like you to make public the fact that a similar result might have occurred had the washer been manually driven.

"Really, electricity had nothing to do with the injury to the lady's hand. The wringer was fitted with the latest safety devices, but the 'release,' fitted to both hand and power wringers, and fully explained in the instruction book, appears to have been utterly ignored.

"As with washing machines, so with sewing machines, it is impossible to make them 'fool-proof,' no matter whether they be driven by hand or by an electric motor.

"The sales of electric washing machines during the past two years have been ever increasing. Thus far they have been confined to those of American or Canadian manufacture, but half of the British manufacturers of washing machines have for some months been experimenting with electric motors, and last week one of them, Messrs. Whittaker Bros., of the Pioneer Works, Accrington, was able to complete its arrangements for producing an English electric washer.

"As regards the use of electric motors for domestic sewing machines, this country is far behind the United States; but I understand that there are a round dozen British firms which are engaged in constructing motors that will allow the housewife to use both hands for guiding and manipulating the fabrics she desires to sew without recourse to the pedal. In other words, the sewing machine of the future will be of the hand and not the pedal type, the motor, not the 'hand,' working the machine.

"Speaking from an experience of over 35 years, and after a study of the British fractional-power motors which are now being made, I am of opinion that when current is universally obtainable the 'hand' sewing machine will entirely take the place of the treadle type, but be driven by electric power. And this will come about the more readily because the expense of the motor will not be much greater than that of the stand and treadle.

"Beyond question, there is in prospect a big business in connection with the driving of sewing and washing machines by fractional electric motors, and I sincerely hope that British electricians will not omit to note this fact."

The following interesting notes are also due to Mr. Sewell: The electric washing machine was first patented by an Englishman named G. H. C. Monckton as long ago as 1874, but none was actually made. The first American washer driven by electricity, 14 years ago, was the "Thor," of which 600,000 have been sold. There are now 71 makers of washers in the United States and three in Canada; in this country there is only one. The sales of washing machines in the United States, mostly electrically driven, in 1920 were 880,000, and the total number in use in the United States, according to the statistics of the American Washing Machine Association, was 2,500,000. According to an article by Miss Mary Gwynne Howell in the *Daily Express*, the washing for a family of five costs at a commercial laundry 30s. a week; home washing by hand costs 15s. 6d., and by electric washer, including hire of the machine, 5s. 10d.

Our thanks are due to Mr. Sewell for these data. We understand that Mr. Samuel Jackson, of Shipley, Yorks., is manufacturing, in this country, a washing machine of American design, and the "Bell" Washer Co., of Blackburn, also makes a type of washer specially adapted to an electric-motor drive.

**The Reichenberg Fair.**—For the Reichenberg Fair, which will be held from August 12th to 20th, applications for exhibiting space close on April 15th. Particulars may be obtained from the Management, Wienerstrasse 20, Reichenberg, Czecho-Slovakia.—*Reuter's Trade Service* (Prague).

## INSTITUTION NOTES.

**Institution of Electrical Engineers.**—Wireless Telegraph Aerial.—Arrangements are being made for the erection of a permanent wireless telegraph aerial on the roof of the Institution building.

Western Centre.—The 45th ordinary general meeting of the Western Centre was held at the South Wales Engineers' Institute, Cardiff, on Monday last, and the "draw" for the evening was the visit of the president (Mr. J. S. Highfield) who gave an address on "Commercial Development." Mr. Highfield reviewed the development of the electricity supply industry from the passing of the Act of 1882 up to the Electricity (Supply) Act of 1919, and at the close a short discussion ensued to which Messrs. Chamen, Morley-New, Nicholls-Moore, Rogers, Roberts, Tremain, Burr, Bowman, and Prof. F. Bacon contributed.

After the general meeting an adjournment was made to the Royal Hotel, where the President was entertained at dinner, and an attendance of nearly 100 gave the toast of the Institution a cordial reception. Speeches were cut to the minimum, as the excellent musical programme provided by Mr. Haydyn Shaw obviated any reference to technical or controversial matters. The joint hon. secretary (Mr. C. T. Allan) is to be congratulated on the admirable arrangements he made for this very pleasing function.

Electricity in Agriculture.—At the Institution of Electrical Engineers on March 30th, at 5.30 p.m., a paper on the "Application of Electricity to Agriculture" will be read; and another on "Electric Power as an Aid to Agriculture" will be delivered at the Farmers' Club, 2, Whitehall Court, S.W.1, at 4 p.m. on April 3rd, by Mr. Borlase Matthews, M.I.E.E.

**Birmingham and District Electric Club.**—At a meeting to be held on February 11th, Mr. C. G. A. McDonald will give a lecture on "Illumination," illustrated by lantern slides. The eleventh annual dinner will be held at the Grand Hotel on February 24th. An excellent musical programme has been arranged and a number of distinguished guests have been invited.

**Institute of Metals.**—The annual general meeting of the Institute will be held at the Institution of Mechanical Engineers on March 8th and 9th, when a selection of papers will be presented and discussed. The annual dinner will be held on March 8th, and the Royal School of Mines will be visited on March 9th. Sir Ernest Rutherford, F.R.S., will deliver the twelfth May lecture on May 3rd, his subject being "The Relation of the Elements," and the annual autumn meeting of the Institute will take place at Swansea on September 20th and 22nd.

**Chelmsford Engineering Society.**—At a meeting held on January 26th, Mr. G. H. Ayres, A.M.I.Mech.E., A.M.I.E.E., of Industrial Waste Eliminators, Ltd., gave an illustrated lecture on "The Reclamation and Utilisation of Waste in Factories." Various methods of recovering oil from metal turnings, dirty wipers, cotton waste, &c., were dealt with. The apparatus recommended for this purpose was the turbine type of centrifugal extractor. The peripheral speed of the extractor should be 6,000 or 7,000 ft. per minute, and by having the turbine blades fastened direct to the under side of the cage, this was easily obtained. The exhaust steam passed into the upper part of the machine, liquefying the oil, which was then more easily thrown off from the material under treatment. Nearly a gallon of oil could be recovered by this process from 1 cwt. of turnings.

At a meeting held in the Agricultural Institute on February 2nd, Mr. T. Britten, manager of Messrs. Crompton & Co., Ltd., in the chair, Mr. H. G. Allen, M.A., M.Inst.C.E., managing director of the Queen's Engineering Works, Bedford, read a paper on "The Design and Operation of Condensing Plant." For each pound of coal burnt in the boilers, he said, it was usual to pass 500 or 600 lb. of cooling water through the condensers. The output of an engine exhausting to the air might be increased about 40 per cent. by the use of an efficient condenser. It was usual to extract the air and condensate by two separate pumps or ejectors, the steam jet ejector being preferred, and efficiency was only obtained when the amount of non-condensable vapour in the condenser was a minimum; from 25 to 35 lb. of air had to be dealt with per 100,000 lb. of steam used. An interesting series of lantern slides was shown, and a long discussion followed the lecture.

**Electrical Power Engineers' Association.**—An informal discussion on "Boiler Troubles" will take place on Friday, February 24th, at the Engineers' Club, Coventry Street, S.W., at 7 p.m.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

We regret to learn from the Manchester *Daily Dispatch* that the prolonged ill-health of Mr. J. M. M'Elroy, general manager of Manchester tramways, has for some time been a matter of anxiety to the Tramways Committee. The committee is naturally very anxious to retain his services, and a sub-committee has been appointed to go into the matter and make a recommendation. In the circumstances it is probable, says our contemporary, that Mr. M'Elroy will be retained in an advisory capacity in any rearrangement of the personnel of management which may be necessary. That, it is understood, was the recommendation arrived at by the sub-committee on February 2nd. The whole matter will, of course, be settled by the full committee.

Our readers will join with us in feelings of regret that Sir John Snell had to retire from the chair during the Electricity Commissioners' inquiry at Barrow, on February 1st, into the North Lancashire and South Cumberland Electricity District scheme. Mr. H. Booth took his place. Sir John intimated that Mr. Booth would be joined later by another commissioner, Mr. A. Page, and he hoped that his retirement would not prejudice the inquiry in any way.

The following re-arrangements in the staff of the Liverpool Electricity Supply Department have been approved by the City Council:—Mr. E. L. Morland, mains superintendent, to be distribution engineer at £525 per annum, and bonus; Mr. C. M. Lucas, assistant electrical engineer, to be assistant distribution engineer at £350 per annum, and bonus; Mr. A. E. Aird, assistant engineer, to be assistant electrical engineer at £270 per annum, and bonus; Mr. W. Mayhew high-pressure inspector, to be assistant engineer, at £205 per annum, and bonus; Mr. T. B. Owens, high-pressure switchboard inspector, to be assistant engineer, at £210 per annum, and bonus; Mr. J. P. Higgins, mains engineer, to be high-pressure engineer, at £235 per annum, and bonus; Mr. J. H. Murray, mains engineer, to be district mains engineer, at £215 per annum, and bonus; Mr. C. F. Reid, mains engineer, to be service mains engineer, at £190 per annum, and bonus; Mr. C. L. Eagle, assistant mains engineer, to be district mains assistant, at £125 per annum, and bonus; Mr. F. C. Carmen, mains assistant, to be senior mains assistant, at £235 per annum, and bonus; Mr. A. E. Lewis, mains assistant, to be senior mains assistant, at £230 per annum, and bonus; Mr. S. R. Holliway, station engineer, to be shift engineer, at £220 per annum, plus the E.P.E.A. bonus; and Mr. T. Herbert Thomas, shift engineer, at £220 per annum, and bonus.

At the annual supper of the Scarborough tramway employés last week, Mr. Moinet, manager of the tramways, was presented by the staff and employés with a gift of cutlery as a mark of their appreciation on his leaving the town to take up a position in Scotland at an early date. The gift was handed over by Mr. Cordukes, head of the office staff.

Mr. E. L. Wood, of the engineering staff of the Glasgow Corporation electricity department, who has been for the past fifteen months assisting the engineering staff of the gas department with the installation of the electrical plant at Provan Gas Works, has been transferred from the electricity department to the gas department as electrician-in-charge of the electrical plant at the gas works at £260 per annum, plus a bonus of £128.

Mr. Andrew Lindsay, chief electrician at Killochan Collieries to the South Ayrshire Collieries, Ltd., for over seven years, was made the recipient of an overmantel from employés and others on leaving to enter upon an engagement at Lochgelly, Fife.

Mr. E. E. Pope has been appointed mains superintendent at the Maidstone municipal electricity works.

Mr. E. J. Williams, Scottish district manager to Messrs. Edmundsons Electricity Corporation, Ltd., and manager to the Inverness undertaking, left London on the P. & O. *Mantua* on the 3rd inst. for Marseilles *en route* to Italy, where, with a client, he is visiting some hydro-electric schemes.

The *Daily Express* reports that M. E. Galvanauskas, an electrical and mining engineer, is the new Lithuanian Premier.

**Obituary.**—Sir Francis Barker.—We referred briefly in our last issue to the death of Sir Francis Henry Barker, a director of Messrs. Vickers, Ltd., which took place at Cannes on January 28th. Sir Francis had been ill for a considerable time, having undergone an operation last year, from which, however, he seemed to be making a good recovery. He went to Cannes for his convalescence, and there a second operation was found to be necessary. From the effects of this he never rallied. Sir Francis was born at Smyrna in June, 1865, the second son of the late Alfred Barker, of Constantinople and Elmfield, Esher, and was educated privately and at Clifton College. He received his early business training in his father's bank in Constantinople, subsequently becoming private and confidential secretary to Sir Edgar Vincent (the present Lord D'Abernon), at that time Director-General of the Imperial Ottoman Bank at Constantinople. During this period he travelled extensively in Syria and other parts of Asia Minor. In 1890 the Parsons' Foreign Patents Co., Ltd., was formed to exploit on the continent of Europe Sir Charles Parsons's patents for marine and land turbine work. Sir Francis Barker was appointed manager of this company, and as such was instrumental in forming subsidiary companies in various foreign countries, and in establishing works under the Parsons patents for the manufacture of land and marine turbines in those countries. He maintained his association with the Parsons Foreign Patents Co., Ltd., to the end, and at the time of his death was a director of the company. In Russia, and especially in Russo-British affairs, he always evinced the liveliest interest. He was president of the British Russia Club and chairman of the Executive Council of the Russo-British Chamber of Commerce. As organiser and founder, with Lady Barker, of Kitchener House, Grosvenor Place, Sir Francis will be held in affectionate remembrance by many officers and ex-officers who there received technical and commercial training in preparation for their entry, not only into civil employment, but, in many cases, into Government service. Sir Francis was instrumental in acquiring for Messrs. Vickers a most important concession from the Russian Government for the supply of naval guns to be manufactured at the Tzaritzyn Works in South Russia, which works were constructed to Messrs. Vickers's plans and designs. These works were completed under great difficulties during the war. Owing to Sir Francis's great foresight, wide experience and untiring energy—his capacity for work was enormous—the supply of a very large amount of guns and munitions was arranged for the Russian armies during the war, and torpedo works were established in South Russia for the supply of torpedoes to the Russian Navy. Under his guidance technical advice and supervision was also provided for the Nicolaieff shipyards in connection with the construction of battleships. He used his best endeavours to promote trade with Russia, and already at the outbreak of the Revolution had established the nucleus of a very good business in the supply of electrical material, and many working agreements had been entered into with large Russian shipbuilding and engineering firms, which may still prove to be very useful in the recuperation of Russia.

*Mault & Fox* [*London.*

Sir Francis Henry Barker.

We regret to learn from *Reuter* that Mr. Marshall, the local manager of the Eastern Extension Telegraph Co., Ltd., at Shanghai, has died of scarlet fever.

**Will.**—The late Mr. Arthur Barrett, managing director of Baily, Grundy & Barrett, Ltd., engineers, Cambridge, left £7,909.

## NEW COMPANIES REGISTERED.

**Cooper & Smith, Ltd.** (179,462).—Private company. Registered February 3rd. Capital, £12,500 in £1 shares. To acquire the business of electric motor and cutter manufacturers and dealers lately carried on by the Portable Electric Motors (1919), Ltd., at 121, Victoria Street, S.W., and elsewhere. The first directors are: J. Cooper, 1, Manor Mansions, Belsize Park Gardens, N.W.; engineer; J. W. P. Smith, Swan Hotel, Bolton. Registered office: Station Road, Maldon, Essex.

**Unipressure, Ltd.**—Particulars of Unipressure, Ltd., have been filed pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in Jersey on October 8th, 1921, with a nominal capital of £50,000 in £1 shares, to adopt an agreement with G. Le Marchand and to carry on business as financiers, concessionaires, merchants, prospectors, explorers, miners, mechanical and electrical engineers, suppliers and transmitters of electricity and electric energy for lighting, heating, power, telegraphic, telephonic or other purposes, merchants, manufacturers, commission and general agents, &c. The directors are: A. S. Elmore, The Grove, St Lawrence, Jersey, engineer; R. H. Bingham, 10, Eastbrook Road, Shooter's Hill Road, Blackheath, S.E., engineer; F. W. Brackett, "Olive Dene," Seaville Crescent, Walton-on-the-Naze, Essex, engineer; and Dr. Friedrich Esser, 45, Bismarck Strasse, Cologne (of German nationality). Alternate director to Dr. F. Esser: A. R. Korkhaus, 33, Dorset Square, N.W.1. (a British subject of German origin). The address of R. H. Bingham was originally written on the filed document as "c/o Huntington, Heberlein and Co., Ltd., 18, Iddesleigh House, Caxton Street, S.W.1," and that of F. W. Brackett as "c/o F. W. Brackett & Co., Ltd., Hythe Bridge Iron Works, Colchester," but those addresses were struck out and the residences inserted. (The Act specifies "usual residence.") The British address is 701, Salisbury House, E.C.2, where J. A. Stocker, chartered secretary, is authorised to accept service of process and notices on behalf of the company. The file number is 2066F.

**Newcastle General Supply Co., Ltd.** (179,438).—Private company. Registered February 2nd. Capital, £500 in £1 shares. To take over the business and assets (but not liabilities) of C. Jack, trading as the "Newcastle and General Supply Co.," at 156, Northumberland Street, Newcastle-on-Tyne, and to carry on the business of factors of and agents for electric lamps and all kinds of electric or similar goods, electrical engineers, agents, publishers of books dealing with electrical engineering, &c. The permanent directors are: R. J. J. Bigley, 31, Hulme Avenue, Tynemouth, traveller; J. McDonald, 31, Grosvenor Drive, Whitley Bay, engineer; G. R. Pawson, "Tyneville," Tynemouth, traveller. The directors may borrow up to the amount of the paid-up capital. Qualification, 50 shares. Registered office: 156, Northumberland Street, Newcastle-on-Tyne.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Saunders Electrical Co., Ltd.**—Satisfaction in full on January 13th, 1922, of charge dated September 9th, 1920, securing £500.

**Keighley Electrical Engineering Co., Ltd.**—Satisfaction in full on January 13th, 1922, of first mortgage debenture, dated December 16th, 1909, securing £5,000. Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated January 16th, 1922, to secure all moneys due or to become due from company to Barclay's Bank.

**Culkin & Parkinson, Ltd.**—Particulars of £400 debentures, authorised January 12th, 1922. Whole amount issued. Charged on the company's undertaking and property, present and future, including uncalled capital.

**Oswestry Electric Lighting and Power Co., Ltd.**—Particulars of £1,500 debentures, authorised January 10th, 1922. Present issue, £800, charged on the company's property, present and future, including uncalled capital.

**Sheerness and District Electric Power and Traction Co., Ltd.**—Satisfaction in full on January 1st, 1922, of debentures dated February 12th, 1915, securing £200. Also issue on November 10th, 1921, of £200 second debentures, part of a series already registered.

**Electrical Specialities Co., Ltd.**—Debenture dated January 28th, 1922, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital, if any, registered. Holder: Mrs. J. Dunkerley, 12, Oakdale Road, Sheffield. Particulars of £12,500 debentures, authorised by resolution of even date, also filed. Present issue, £4,000, charged on above-mentioned property.

**Banbury and District Electric Supply Co., Ltd.**—Satisfaction in full on December 31st, 1921, of debenture dated March 26th, 1913, securing £100.

**Jones & Pordes, Ltd.**—First mortgage debenture, dated January 4th, 1922, to secure £1,000, charged on the company's undertaking and property, including uncalled capital. Holder: Mrs. J. Jones, 6, Stanley Street, Broadstairs.

## CITY NOTES.

**Melbourne Electric Supply Co., Ltd.**

*The Times* states that this company, which during the war raised a 6 per cent. loan in the United States, has again resorted to America for funds. It has just issued $2,500,000 (£500,000 at par) seven-and-a-half per cent. general mortgage sinking fund bonds repayable in 25 years. These bonds were offered in America last week, and the loan was over-subscribed in half an hour. To the extent of approximately one-half the money is required to meet the outstanding balance of the earlier issue referred to, which falls due on March 1st. *The Times* Melbourne correspondent states that of the remainder of the loan the greater proportion will be absorbed by the purchase of machinery in the United States, but Mr. W. E. Lane, the secretary of the company, writes to ohr contemporary correcting this part of the statement. He says that as a fact, not more than one quarter of the net proceeds will be absorbed by such purchases, leaving three-quarters for remittance to London and Melbourne for expenditure on the general purposes of the company.

**British Columbia Electric Railway Co., Ltd.**

In their report for the year ended June, 1921, the directors state that the following charges have been made against revenue account:—Provision for depreciation, sinking fund and renewals £149,712, provision for Corporation Profits Tax £29,000= £178,712. The net revenue, after making these deductions, amounts to £421,277, plus £12,646 brought forward. Interest on debentures and debenture stock absorbs £132,231; dividend on the 5 per cent. cumulative perpetual preference stock for the year, £72,000; interim dividends on the preferred and deferred ordinary stocks at 3½ per cent., free of income tax (and income tax thereon), £132,197; leaving available for further distribution £97,495. The directors now recommend a final dividend on the preferred ordinary stock at the rate of £1 3s. 8d. per cent. per annum, free of income tax, making the total £4 13s. 8d. per cent., free of income tax, for the year (and income tax thereon), requiring £22,347, and a final dividend on the deferred ordinary stock at the rate of £2 14s. 2d. per cent. per annum, free of income tax, making the total £6 4s. 2d. per cent., free of income tax, for the year (and income tax thereon), requiring £51,147, leaving £24,000 to carry forward.

Having regard to the general depression in trade and industry which has been prevalent throughout the world, the results of the year are satisfactory. Owing to the high cost of living, the company had to concede demands for increased wages in October, 1920, but since that time there has been a substantial fall in the cost of living and an adjustment of wages in a downward direction is being made. On the other hand, taxation continues to increase. The following statement shows the amount paid for the year 1921, as compared with the previous years of 1919 and 1920:—

| | 1919. | 1920. | 1921. |
|---|---|---|---|
| | $ | $ | $ |
| Dominion Government Income Tax ... ... ... | 67,031 | 133,252 | 139,000 |
| Provincial Government Revenue and Property and Land Tax ... ... ... ... ... ... | 69,550 | 77,832 | 97,085 |
| Municipal Taxation ... ... ... ... ... ... | 153,555 | 207,267 | 212,850 |
| | $290,136 | $418,351 | $448,935 |

The above figures include the taxes paid by or assessed against the Western Power Co. of Canada, Ltd., during these years. In addition there is a sales tax, the amount of which runs up to 3 per cent. of the value of goods purchased, and it is estimated that the cost of this tax to the company is not less than $35,000.

The acquisition of the Western Power Co. of Canada has enabled this company to effect substantial economies in administration, and to increase the efficiency of the service to the public. The report refers to negotiations that have been in progress regarding fares and the revision of the company's franchises, but which have not been successful. The directors are now giving consideration as to the best steps to be taken to preserve the company's interests when the present agreement for the regulation of fares expires on July 1st, 1922. Notwithstanding the depression which has existed for some time past, the indications from traffic returns and from light and power department results are that the earnings of the company will be maintained during the year to June, 1922. The demand for light, power and gas continues to be brisk in consequence of the large amount of building now going on in various districts. While there has been a falling off in the consumption of some power customers, particularly in the lumber industry, this appears to be only temporary, and with renewal of the demand for lumber by the Prairie markets, the mills may soon be expected to resume operation. There have been many valuable power customers added during the year.

**Yorkshire Electric Power Co.**—A meeting is to be held on February 21st to consider the company's further powers Bill now before Parliament.

**Indo-European Telegraph Co., Ltd.**—The accounts for 1920 show, after deducting dividends amounting in all to £2 10s. per share, free of tax (including 15s. per share from equalisation of dividends fund), that there is a credit balance of £16,620. This is carried forward to the 1921 accounts.

**Metropolitan Railway Co.**—The directors recommend a dividend for the past half-year at the rate of 3½ per cent. per annum, making 2¼ per cent. for the year, against 1¼ per cent. for the preceding year; £50,000 is placed to reserve, and £17,800 carried forward.

**Hong Kong Tramway Co.**—A final dividend of 1s. 7d. per share, making 2s. 7d. for the year, is proposed. The profit was £57,449, plus £10,911 brought forward. £26,381 is being carried forward.

**Lanarkshire Tramways Co.**—The revenue during 1921 was £227,450, and the expenses were £188,510, leaving £38,940. £10,000 is put to reserve for depreciation. A further dividend of 6¼ per cent. per annum is declared for the last half-year, making a total of 5¼ per cent. for the year. £2,183 is carried forward. The revenue shows a reduction of £2,096, due to the coal stoppage and severe trade depression last year. The expenses were reduced by £9,457 in spite of additional expenditure involved by the coal stoppage. Unfortunately local rates and taxes were again higher, and amounted to approximately £15,000. Insurances were also materially in excess of the previous year's charges, and Health and Unemployment Contributions at £1,400 also show a very substantial increase. The expenditure on track renewals during the year, amounting to £5,977, has been debited to depreciation reserve. Completion of the purchase of the Lanark County Council tramways was made in May last.

**Calcutta Electric Supply Corporation, Ltd.**—At an extraordinary general meeting held in London last week a resolution was passed authorising the borrowing of £500,000. It is reported that Lord Meston, who presided, said that to meet the ever-growing demands the generating plant capacity, which would this year be increased from 21,000 to 42,000 kW, would require to be further augmented next year by the addition of a 15,000-kW set. For the latter and certain other urgent requirements another £500,000 would be required. If members approved, the Trade Facilities Act Advisory Committee were willing to recommend to the Treasury that it should arrange a loan of that amount and guarantee on behalf of his Majesty's Government both the capital and the interest.

**German Capital Increases.**—The Hartmann & Braun Co., of Frankfort-on-Main, which a year ago increased its share capital to 4,400,000 marks, now proposes to raise the capital to 10,000,000 marks by the issue of ordinary shares for 5,400,000 marks and preference shares for 200,000 marks, the latter having eight votes each. The augmentation is due partly to the altered conditions in the value of money and partly to defray the cost of two new extensions of the works. A new 5 per cent. loan for 20,000,000 marks is to be raised by the Electricity Company, late Lahmeyer & Co., of Frankfort-on-Main, to deal with pending transactions and serve the future needs of subsidiary companies.

**Tyneside Tramways & Tramroads Co.**—For the half-year ending December, 1921, the surplus of receipts over expenses was £4,970. After paying interest on mortgages, &c., and 5 per cent. pref. dividend, a dividend at the rate of 2 per cent. per annum (less income tax) on the ordinary shares is recommended, making 2¼ per cent. for the year. £500 is put to reserve and £591 carried forward. The traffic receipts show a decrease of £5,051 as compared with the corresponding half-year of 1920, and for the whole year there was a decrease of £3,871.

**Stock Exchange Notices.**—The Committee has ordered the following to be officially quoted :—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—1,500 dols. common stock.

London Electric Railway Co.—£200,000 4 per cent. debenture stock.

Waygood-Otis.—40,000 ordinary shares of £1 each, fully paid (Nos. 250,001 to 290,000).

**St. James' & Pall Mall Electric Light Co., Ltd.**—A balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1921, of 3s. 6d. per share and 8s. 6d. per share on the ordinary shares, making, with the interim dividend paid thereon, a total distribution of 12 per cent. for the year, are recommended.

**Electrical and Industrial Investment Co., Ltd.**—According to the *Financier* the profit for the year to December 31st, 1921, was £13,054 and £21,028 was brought in. A dividend at the rate of 6 per cent. for the year on the preferred ordinary shares is recommended, carrying forward £22,082, subject to corporation tax for 1920 and 1921.

**France.**—The Groupement des Compagnies d'Energie Electrique et d'Eclairage du Nord et de d'Est, of Paris, has just invited subscriptions for 165,000 6 per cent. shares of 500 fr. each, offered at 475 fr. and repayable at par in 30 years.

**Sweden.**—The Electric Power Co., Aktiebolaget Krafintressenter, has decided to increase its share capital by kr. 1,180,000, thus raising it to kr. 2,620,000.—*Reuter's Trade Service* (Stockholm).

**National Gas Engine Co., Ltd.**—The net profit for 1921 was £42,258. A final dividend of 1s. per share on the ordinary shares for the December half-year is recommended, and £33,681 is to be carried forward.

**Greenwood & Batley, Ltd.**—Interim dividends of 2¼ per cent. on the ordinary and 3¼ per cent. on the preference shares have been announced.

**J. G. White & Co., Ltd.**—Meetings of the company, and of the preference shareholders separately, are to be held to-day, Friday, to consider a capital re-organisation scheme.

**Clontarf & Hill of Howth Tramway Co., Ltd.**—A dividend of 3s. per share and a bonus of 1s. per share are to be paid, and £105 is to be carried forward.

**Smithfield Markets Electric Supply Co., Ltd.**—A dividend at the rate of 5 per cent. per annum for 1921 is announced, carrying forward £1,550.

**Sunderland District Tramways, Ltd.**—Interest is to be paid at the rate of 5 per cent. per annum (less tax) on the first and second income bonds, absorbing £4,065. £927 is to be carried forward.

**Central Electric Supply Co.**—After putting £37,645 to depreciation, the accounts for 1921 show a loss of £7.

## STOCKS AND SHARES.

Tuesday Evening.

After showing pronounced hesitation, the investment markets of the Stock Exchange have again taken a turn for the better, and, although business is quiet, the investor is obviously on the look-out for stock. This applies to electricity supply shares, where prices have been steadily mounting week by week this year, and the movement fails to dislodge any amount of stock worth mentioning. The Home Railway dividends produced one or two mild thrills, the Metropolitan being regarded as one of the most promising, and bringing about a sharp rise in the stock.

This dividend from the Metropolitan was at the rate of 3¼ per cent. per annum, making 2¼ per cent. for the year, as against 1½ per cent. for 1920. The price of the stock promptly rose to 30, eased off and again advanced to 30½. Districts moved in sympathy, expectation looking to some kind of distribution in the autumn, the first for a period of forty years so far as the ordinary stock is concerned. Central Londons are steady, and Underground Incomes, after giving way to 72, rallied to 75½. The prior-charge stocks not only hold their rises, but show several improvements upon them in several cases. The speculative investor is looking with a friendly eye upon East London debentures, and as there is very little stock in the market, it does not take much in the way of demand to cause the price to strengthen.

The British Columbia Electric Railway Co. has declared practically the same dividends as those of a year ago, making £4 13s. 8d. on the preferred and £6 4s. 2d. on the deferred. The pence show the improvements as compared with a year ago. These announcements are in accordance with previous anticipation, on the strength of which prices have been advancing. The company's report, however, is less glowing than some people expected it to be, and the result is that prices barely hold their ground. Brazilian Tractions are moving more or less in consonance with the Rio rate of exchange, and the Brazilian position is still obscure. Mexicans mostly hold their substantial rises; some of the issues made further progress. The rise in value of the £ as compared with the dollar is responsible for the marking down of many of the dollar stocks quoted in the Stock Exchange. As the majority of the bonds, &c., have crossed the Atlantic, either under the mobilisation of securities scheme or through sales by people who discreetly realised their American stock when the dollar stood so high, such changes are mostly of academic interest to capitalists in this country.

Electricity supply shares keep good. Week by week, rises take place in the leading shares, and this time there are improvements in Bromptons, Charing Cross, County of London ordinary and preference, Kensingtons, London Electrics and South Metropolitan preference. All the advances of last week are maintained, and there is noticeable eagerness to secure any stock which comes to market. It is said that there is in contemplation a possible issue of 8 per cent. second preference stock by the North Metropolitan Electric Power Supply Co. Some time ago the company made an issue of 7½ per cent. debenture stock which, now standing at 103, is substantially higher than the original price. The company's existing 6 per cent. preference shares are quoted at 15s. Gossip also concerns itself with the possibility of other electrical companies appealing for more money in the near future, though the check imposed upon the rush of new stocks may have something to do with the delay in bringing forward certain of the proposals that are said to have been well advanced.

A small gamble has sprung up in the shares of the London and Suburban Tramways Co., the preference being quoted at 7s. 6d. and the ordinary at 1s. 9d. The preference, which are cumulative, carry arrears of dividend from June, 1918, and vague talk of some arrangement being made whereby these arrears will be met, either in cash or otherwise, has brought about increased attention to the shares. At the same time, London United Tramways preference developed a little activity, the price being raised to 3s. 9d., from which, however, it has fallen back to 3s. 3d. An unconscious humorist asked the other day if there were any truth in the report that the London and Suburban Traction was going to be taken over by the London County Council. British Electric Tractions are steady, the ordinary at 36½ and the 5 per cent. participating preference at 64½, though business in the stocks has fallen away.

Telegraph and cable shares are firm throughout. Eastern Extensions have risen to 17, Westerns to 17½, while Eastern

ordinary is a trifle over 170. In the steady demand for all investment stocks, these cable descriptions are bound to participate, and, although it may appear extravagant to assume anything like 20 as the ultimate goal of the group, the fact remains that, even at the current quotations, the yield on the money comes to over 6¾ per cent. free of tax, or equivalent to 9¼ per cent., taking tax at 6s. in the £. In Marconis the principal interest continues to centre in Radio Corporation shares. The Common are jumping about a good deal. From 18s. 9d. the price dipped swiftly to 17s. 3d., recovering again to 18s. 6d., at which they stand this, Tuesday, evening. The preferred have improved to 13s. 3d., but Canadian Marconis are dull at 7s. Marconi Marines strengthened to 23s.; there is nothing much doing in these at the moment.

Siemens at 23s. are 1s. better, and most of the telegraph manufacturing shares hold their prices with pronounced strength. Edisons shed a shilling at 4s 3d., the market being a melancholy one. General Electric ordinary remain dull at 19s. 6d., and the preference at 18s. 9d. are 6d. easier. English Electric preference at 12s. 6d. are 1s. 3d. down. Last week's improvements in British Insulated, Callender's and Henley's have been maintained. Metropolitan-Vickers preference keep at 37s. 6d., but the ordinary, after being a little over £1, receded to 18s. 9d., there being several sellers about. Vickers were advanced in sympathy with the rise in Metropolitan-Vickers, but dropped back to 7s. 9d.; other armament shares also lean to the dull side, while the rubber market remains inanimate, owing to the depression in the price of the raw material.

British Thomson-Houston new debenture is firm at 5¼ premium. Investors continue to take the Fife Tramway 7 per cent. debenture, up to 5¼ premium. Midland Counties 7½ per cent. debenture is a good market at 102 and General Electric debenture at 102¼. Llanelly Electric new scrip is 98 middle.

## SHARE LIST OF ELECTRICAL COMPANIES.

| | Dividend. 1919. | Dividend. 1920. | Price Feb. 7, 1922. | Rise or fall. | Yield p.c. |
|---|---|---|---|---|---|
| **Home Electricity Companies.** | | | | | |
| Brompton Ordinary | 12 | 12 | 6¾ | + ¼ | £8 17 10 |
| Charing Cross Ordinary | 7 | 8 | 4½ | + ½ | 8 4 2 |
| do. do. do. 4½ Pref. | 4½ | 4½ | 2½ | — | 6 18 6 |
| Chelsea | 4 | 6 | 3¾ | — | 8 5 6 |
| City of London | 13 | 14 | 1¾ | — | 9 6 8 |
| do. do. 6 per cent. Pref. | 6 | 6 | 19/- | — | 6 6 4 |
| County of London | 8 | 8 | 2¾ | + ¼ | 8 4 2 |
| do. do. 5 per cent. Pref. | 6 | 6 | 3½ | — | 7 2 10 |
| Kensington Ordinary | 7 | 9 | 5½ | + ¼ | 8 3 8 |
| London Electric | 2½ | 2½ | 1½ | + ⅛ | 6 0 0 |
| do. do. 6 per cent. Pref. | 6 | 6 | 2½ | — | 9 4 7 |
| Metropolitan | 6 | 7 | 4½ | — | 7 15 7 |
| do. 4½ per cent. Pref. | 4½ | 4½ | 3⅛ | — | 7 1 2 |
| St. James' and Pall Mall | 12 | 12 | 7 | — | 8 11 6 |
| South London | 6 | 7 | 2¾ | — | 10 9 0 |
| South Metropolitan Pref. | 7 | 7 | 1⅞ | + ⅛ | 6 11 8 |
| Westminster Ordinary | 10 | 10 | 6½ | — | 7 13 10 |
| **Telegraphs and Telephones.** | | | | | |
| Anglo-Am. Tel. Pref. | 6 | 6 | 91 | — | 6 11 10 |
| do. Def. | 1½ | 1½ | 19 | — | 9 3 6 |
| Chile Telephone | 6 | 6 | 6½ | — ¼ | 5 14 3 |
| Cuba Sub. Ord. | 7 | 7 | 7½ | + ½ | 9 6 8 |
| Eastern Extension | 10 | 10 | 17 | + ¼ | 5 17 8 |
| Eastern Tel. Ord. | 10 | 10 | 170½ | + 1 | 5 17 4 |
| Globe Tel. and T. Ord. | 10 | 10 | 17 | — | 5 17 8 |
| do. do. Pref. | 6 | 6 | 9¾ | — | 6 1 6 |
| Great Northern Tel. | 22 | 24 | 26½ | — | 8 19 2 |
| Indo-European | 10 | 10 | 82 | + 1½ | 7 16 3 |
| Marconi | 25 | 15 | 1¾ | — | 8 11 6 |
| Oriental Telephone Ord. | 12 | 12 | 2 | — | *6 0 0 |
| United R. Plate Tel. | 8 | 8 | 6⅞ | — | *6 6 9 |
| West India and Panama | Nil | Nil | 6/- | — | Nil |
| Western Telegraph | 10 | 10 | 17½ | + ½ | *5 16 0 |
| **Home Rails.** | | | | | |
| Central London Ord. Assented | 4 | 4 | 57 | — | 7 0 4 |
| Metropolitan | 1½ | 1½ | 20½ | +1 | 7 7 7 |
| do. District | Nil | Nil | 24 | + ½ | Nil |
| Underground Electric Ordinary | Nil | Nil | 1¾ | — | Nil |
| do. do. "A" | Nil | Nil | 6/- | — | Nil |
| do. do. Income | 4 | 2 | 75½ | +2 | *3 19 6 |
| **Foreign Trams, &c.** | | | | | |
| Anglo-Arg. Trams, First Pref. | 5½ | 12½ | 91¾ | — ⅛ | 9 15 6 |
| do. do. 2nd Pref. | Nil | 5½ | 8½ | — | 8 19 6 |
| do. do. 5 per cent. Deb. | 5 | 5 | 71½ | +1 | 6 19 10 |
| Brazil Tractions | Nil | Nil | 33 | —2 | Nil |
| British Columbia Elec. Ry. Pfce. | 5 | 5 | 61½ | +1 | 8 2 8 |
| do. do. Preferred | 5 | 93/- | 58½ | — | *7 18 0 |
| do. do. Deferred | 8 | 124/- | 80½ | —1 | *10 10 0 |
| do. do. Deb. | 4½ | 4½ | 63½ | — | 6 16 0 |
| Mexico Trams. 5 per cent. Bonds | Nil | Nil | 8½ | — | — |
| do. do. 6 per cent. Bonds | Nil | Nil | 22½ | —1 | Nil |
| Mexican Light Common | Nil | Nil | 17½ | +2 | Nil |
| do. Pref. | Nil | Nil | 36½ | +2 | Nil |
| do. 1st Bonds | Nil | 5 | 62½ | —2 | 8 0 0 |
| **Manufacturing Companies.** | | | | | |
| Babcock & Wilcox | 15 | 18 | 2⅛ | — | 8 4 9 |
| British Aluminium Ord. | 10 | 10 | 16/3 | — | — |
| British Insulated Ord. | 15 | 15 | 1½ | — | 8 17 10 |
| Callenders | 15 | 15 | 1⅞ | — | 9 12 0 |
| „ 6% Pref. | 6½ | 6½ | 18/9 | — | 6 18 8 |
| Crompton Ord. | 10 | 10 | 13/9 | — | 14 11 0 |
| Edison-Swan | 10 | — | 4/3 | —1/- | — |
| do. do. 5 per cent. Deb. | 5 | 5 | 82 | — | 8 1 4 |
| Electric Construction | 10 | 10 | 18/9 | — | 10 13 4 |
| English Electric | 8 | 8 | 9/6 | — | 16 17 0 |
| do. Pref. | 6 | 6 | 12/6 | — ⅛ | 9 12 0 |
| Gen. Elec. Pref. | 6½ | 6½ | 18/9 | —6d. | 6 18 8 |
| do. Ord. | 10 | 10 | 19/6 | — | 10 5 4 |
| Henley | 15 | 15 | 1⅞ | — | 9 12 0 |
| do. 4½ Pref. | 4½ | 4½ | 8½ | — | 8 0 0 |
| India-Rubber | 10 | — | ⅞ | — | — |
| Met.-Vickers Pref. | 8 | 8 | 1¾ | — | 8 10 8 |
| Siemens Ord. | 10 | 10 | 23/- | +1/- | *8 18 10 |
| Telegraph Con. | 20 | 20 | 23 | — | *5 4 2 |

* Dividends paid free of Income Tax.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances

### Wednesday, February 8th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Oxalic | per lb. | 8d. | ½d. dec. |
| a Ammoniac Sal | per ton | £65 | £5 inc. |
| a Ammonia, Muriate (large crystal) | „ | £58 | .. |
| a Bisulphide of Carbon | „ | .. | .. |
| a Borax | „ | £31 | .. |
| a Copper Sulphate | „ | £29 | .. |
| a Potash, Chlorate | per lb. | 5d. to 5½d. | .. |
| a „ Perchlorate | „ | 7½d. | .. |
| a Shellac | per cwt | £16 10s. | .. |
| a Sulphur, Sublimed Flowers | „ | £13 10s. | .. |
| a „ Lump | „ | £12 10s. | .. |
| a Soda, Chlorate | per lb. | 9½d. | .. |
| a „ Crystals | per ton | £7 | .. |
| a Sodium Bichromate, casks | per lb. | 7½d. | .. |
| **METALS, &c.** | | | |
| b Aluminium, Ingots | per ton | £120 | .. |
| b „ Wire | per lb. | 1/9 to 2/6 | .. |
| b „ Sheet | „ | 1/6 to 2/- | .. |
| p Babbitt's Metal and Anti-friction Metal— | | | |
| Grade I | per ton net | £147 | £13 dec. |
| Grade II | „ | £106 | £12 dec. |
| Grade III | „ | £62 | £9 dec. |
| c Brass (rolled metal 2' to 12' basis) | per lb. | 10d. | ½d. dec. |
| c „ Tubes (solid drawn) | „ | 1/0½ to 1/0½ | .. |
| c „ Wire, basis | „ | 10½d. | .. |
| c Copper Tubes (solid drawn) | „ | 1/2½ | .. |
| c „ Bars (best selected) | per ton | £91 | £2 dec. |
| c „ Sheet | „ | £94 | £2 dec. |
| c „ Rod | „ | £94 | £2 dec. |
| d „ (Electrolytic) Bars | „ | £72 5s. | 15/- dec. |
| d „ „ Sheets | „ | £145 10s. | .. |
| d „ „ Wire Rods | „ | £85 15s. | 5/- dec. |
| d „ „ H.C. Wire | per lb. | 11d. | ½d. dec. |
| f Ebonite Rod | „ | 8/6 | .. |
| f „ Sheet | „ | 8/- | .. |
| n German Silver Wire | „ | 2/9 | .. |
| h Gutta-percha, fine | „ | 12/6 | .. |
| h India-rubber, Para fine | „ | 11½d. | ½d. dec. |
| l Iron Pig (Cleveland Warrants) | per ton | Nom. | .. |
| l „ Wire, galv. No. 8, P.O. qual. | „ | £27 | .. |
| g Lead, English Pig | „ | £22 10s. | £2 dec. |
| r Mercury | per bot. | £11 5s. to £11 10s. | .. |
| e Mica (in original cases) small | per lb. | 3d. to 3/- | .. |
| e „ „ „ medium | „ | 4/- to 8/- | .. |
| e „ „ „ large | „ | 10/- to 20/- & up | .. |
| p Phosphor Bronze, plain castings | „ | 1/2 | .. |
| p „ „ drawn bars and rods | „ | 1/4 | ½d. dec. |
| p „ „ rolled strip & sheet | „ | 1/4½ | .. |
| p „ „ Wire | „ | 1/3½ | ½d. dec. |
| o Platinum | per oz. | £34 | .. |
| d Silicium Bronze Wire | per lb. | 1/2½ | .. |
| r Steel, Magnet, in bars | „ | 1/8 | .. |
| n Tin, Block (English) | per ton | £155 to £156 10s. | .. |
| n „ Wire, Nos. 1 to 16 | per lb. | 2/3 | 3d. dec. |

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. P. Dennis & Co.

**Competition for the Design of a Moving Platform for Paris.**—We have received from the Préfecture de la Seine particulars of the competition, recently mentioned in our pages, for the design of a moving platform for the conveyance of passengers; in the first instance no route will be assigned to the system, attention being concentrated on the mechanism. There will be three prizes, of 100,000, 50,000, and 30,000 fr. respectively. The schemes will remain the property of their authors, but the City of Paris retains the right to purchase any scheme at a maximum price of 500,000 fr. The competition is open to the world, until September 20th, 1922; an entrance fee of 100 fr. is payable.

The highest speed of the moving platform is not to exceed 15 km. per hour (9¼ m.p.h.); provision must be made for a convenient and safe passage from the fixed to the moving platform. The essay must show clearly what tests the author requires to be made, with special reference to the minimum radius of curvature, the minimum length of tangent line between two curves, and the minimum length of level between two inclines of opposite sense; the cost of these tests will be borne by the City.

Full particulars with regard to the regulations of the competition can be obtained from the Direction des Travaux de Paris, 98, Quai de la Rapée (Bureau de la Voie Publique et du Métropolitain), and technical details from the Service Technique du Métropolitain, 48, rue de Rivoli, Paris. A copy of the conditions is on file at the office of the Electrical Review.

**Cornish Radium.**—The *Westminster Gazette* states that it has been decided to resume mining for radium at the Tolgarrick Mine, in Cornwall, seven miles from Truro. The mine is owned by an English concern, Radium Ore Mines, Ltd. It is expected that the enterprise will meet with appreciable success.

# LIGHTING AND TRAMWAY ADMINISTRATION IN PARIS.

The electricity supply question in the vicinity of Paris presents certain features which greatly resemble the situation of affairs in the London area, although remarkable changes are in progress in the former case, and eventually will probably be repeated to some extent in the English metropolis. There is, however, one very material difference between the two cities, namely, that the supply business in the region of Paris is almost, if not entirely, in the hands of private enterprise, there being no large municipal undertakings.

French interests long ago appreciated the benefits of concentration in the supply industry in order to secure the highest possible degree of economy in working, and this idea is gradually being extended to industries other than that of electricity supply. It is now some years since the different companies in Paris having supply rights in certain districts or secteurs were combined in the Compagnie Parisienne de Distribution d'Electricité, which has a monopoly of supply within the city of Paris for lighting and general power purposes, excluding the railways and the tramways. No doubt the amalgamation was brought about by the pressure of circumstances or, perhaps more correctly, by the pressure exercised by the Municipal Council of Paris as the original conceding authority. Still, the fact remains that the undertakings were combined for the benefit of the general body of consumers, because the amalgamated company was tied down to fixed tariffs, and was, and still is, under the control of the City of Paris. This control was strengthened a year ago, when a new agreement was entered into between the City and the company, providing, among other matters, for a further division of the profits between the two parties and a revision of the tariffs according to the price of coal prevailing at any time. This economic index, as it is termed, has also been authorised in the case of many other French supply companies, and is consequently assisting them now to emerge from the state of almost financial disaster which affected them during the war and the two subsequent years owing to the enormous increase in the price of coal in France, the dearness of other materials, and the rise in wages on the one hand, and on the other the impossibility of raising charges to consumers in consequence of the definite rates fixed in their concession agreements.

The circumstances of the times are also applicable to the supply business just outside the municipal borders of Paris, but in this case there has been no question of attempts at compulsion on the part of the local authorities. What has happened in the suburbs is that certain electrical interests a few years ago conceived the idea of carrying out in the environs a policy of amalgamation similar to that which was undertaken in Paris itself when the Compagnie Parisienne de Distribution d'Electricité was created to absorb all the then secteurs, although the former's agreement with the City of Paris did not come into operation until the beginning of 1914.

It was for the purpose of proceeding with such a concentration of interests in the suburbs that the Union d'Electricité was constituted in 1919, the share capital now being 125,000,000 fr. The first step taken by the new company was to acquire the undertakings of the Compagnie Générale de Distribution d'Energie with its works at Vitry and Billancourt, and the Energie Electrique de la Région Parisienne with works at Nanterre and Issy-les-Moulineaux. Subsequently, the works of the secteurs known as the Triphase, the Ouest Lumière, and the Secteur de la Rive Gauche were sold to the company, the funds thus released permitting the companies concerned to devote their efforts solely to the expansion of their distributing networks.

The chief object of the Union is the concentration of production, which will shortly be inaugurated by the setting in operation of the great works at Gennesvilliers. The concentration will not only ensure great economy, but also increase the security of the supply. As in London, the differences between the systems, comprising three-phase, two-phase and single-phase current at 25, 42, 50 and 53 periods, has hitherto prevented any one of the suburban secteurs coming to the assistance of another in a case of emergency. Now, however, as a result of the influence exercised by the Minister of Public Works, all these different frequencies will shortly be discontinued, and be replaced by a standard 50-cycle supply.

Simultaneously with the erection of the large works at Gennesvilliers, the Paris *Information* states, the Union has been engaged in reconstructing the station at Vitry, where the plant will be increased to 80,000 kW. These two works, situated above and below Paris respectively, will form in some measure the ends of a network of high-pressure distribution constituting a girdle around Paris. The Vitry works in particular will serve as an auxiliary, and eventually as the station for taking the peak load. In addition, the two new works at Nanterre and Issy-les-Moulineaux, which were established specially for supplying the needs of the State railways, will also be kept in service. This group of works, which will be connected with neighbouring groups, particularly the Compagnie Parisienne de Distribution d'Electricité, will form one of the most remarkable combinations existing at the present time.

The Gennesvilliers station, which is in course of completion, is situated on a site of about 22 acres on the banks of the Seine near the Pont d'Argenteuil, and it can be supplied with coal both by waterway and by railway. The work was commenced in 1920, and has been carried out with such rapidity that it was possible last October to begin the erection of the first sets of machines. The first installation comprises plant of a total of 200,000 kW, which is eventually to be increased to 320,000 kW. The turbo-alternators are each of 40,000 kW, and the five in course of erection will be supplied with steam from 15 large boilers. The pressure of the 3-phase energy to be delivered to the old secteurs is 60,000 volts.

### The Unified Tramway System.

What has already been accomplished or is in progress in the case of the electricity supply business, has also been undertaken or is being done in the matter of the tramways.

A year ago this journal reported the amalgamation of the six tramway and omnibus undertakings operating in Paris and the Department of the Seine. The fusion was effected by the expropriation of these undertakings by the General Council of the Seine acting in concert with the Paris Municipal Council, by means of the creation of an annuity system of payment of the purchase price. But notwithstanding the socialistic tendencies of these two authorities, or at least of the City of Paris, the very prudent step was taken by them of deciding to lease the working of the amalgamated transport systems to a company; details of this were set forth in this journal at the time.

It will suffice to mention that the six companies were offered and accepted a new agreement under which they constituted themselves into the new company and proceeded to work the lines on a uniform method for the benefit of the general community under the control of the two authorities concerned.

Having secured the unification of the transport undertakings in the Department of the Seine, the General Council of the Seine recently turned its attention to a neighbouring area—that of the Department of Seine-et-Oise—with a view of extending the region of the co-ordinated system of working. As a result it has been possible for the two Departments to reach an agreement between themselves on the one hand, and with the Compagnie des Chemins de Fer de Grande Banlieue on the other, under which the concessions worked by this

company will be transferred to the General Council of the Seine, as well as the lines from Saint-Germain to Argenteuil and to Maisons-Lafitte.

The Departement of Seine-et-Oise has undertaken to buy out the company, while the General Council of the Seine is to add the acquisitions to its lessee company—the Compagnie des Transports en Commun de la Région Parisienne, for working in conjunction with its existing system representing the amalgamation of all the Paris surface transport companies.

The above facts are a remarkable revelation of the progress taking place in the region of Paris with an eye to the advantage of the general community. There is no cut-throat competition; in fact, the terms of the concessions have not been such as to encourage dangerous rivalry between different companies in the supply business or in that of transport, where such was at all possible.

The principles followed seem to be those of harmonious co-operation between private enterprise and local authorities, the latter taking their share of the profits, where earned, and we believe also bearing some of the losses in the matter of the tramways, when unprofitable under the new régime. All barriers as to districts are gradually being broken down, and the petty jealousies of petty local authorities, so common about London, never appear to be allowed to prevail against the general interest of the community. London, and the London County Council in particular, has indeed a great deal to learn from the region of Paris.

# THE PHYSICAL SOCIETY OF LONDON.

## TWELFTH ANNUAL EXHIBITION.

(*Continued from page* 173.)

Foster Instrument Co.—Various methods of automatic control of temperature have been proposed and used, though it is believed that these have been mainly devoted to maintaining the temperature approximately at a constant figure. While this is a desirable condition for some operations, there are others in which the temperature should vary in accordance with a predetermined programme; for instance, in one important manufacturing operation, employing an electric furnace, it is desired that the temperature should rise fairly rapidly to a certain relatively low value, should be maintained at or near that value for a considerable period, and should then be rapidly heated up to a higher figure, maintained there for a period, and then slowly cooled. The device exhibited by this firm is designed to carry out such a programme. It is only necessary to cut a metal template to the shape of the temperature record of the required programme, of course making allowance for the natural thermal characteristics of the furnace and its contents—that is to say, there will be a certain time lag to allow for and there will be certain maximum and minimum rates of heating and cooling, depending upon the conditions of the furnace.

A thermo-couple is inserted into an electrically-heated furnace, the temperature of which it is desired to control according to a predetermined programme. The thermo-couple is connected to a recorder. The pen of the recorder is connected to a moving-coil permanent-magnet millivoltmeter which, in turn, is connected to the thermo-couple in the furnace, the movements of the pen being, therefore, proportional to the temperature of the furnace. The record is produced by a clock mechanism in the recorder which depresses the pen alternately on to the ink drum at the side of the chart and on to the chart itself. The pen is brought over to the ink

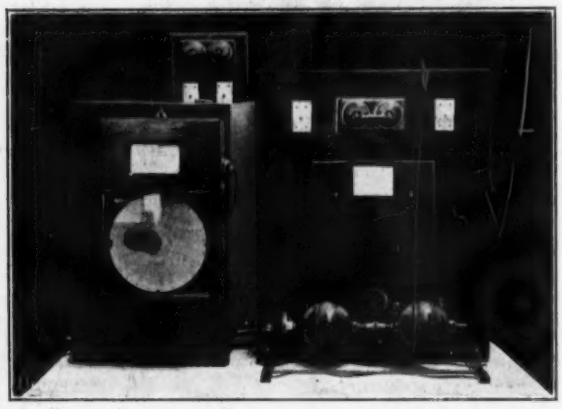

Fig. 22.—Automatic Temperature-control Device.

drum by the clock mechanism and, after it has been pressed on to the ink drum and received ink, the clock mechanism leaves the pen free to take up the deflection proportional to the temperature of the furnace. A divided electrical circuit is arranged, one portion of which comprises the pen arm itself. In one arm of this circuit the contact is made between the pen arm and the circuit when the former is moved over by the clock mechanism towards the ink drum. An alternative circuit is provided when the pen is depressed on to the metal plate which is fixed over the chart, as shown in fig. 22, to form virtually a "template" cut to the shape of the desired temperature programme.

The electrical circuit arrangements are as shown diagrammatically in fig. 23. There is provided in and connected with the recorder a divided electrical circuit coming from the main supply (for instance, a d.c. lighting circuit) through the switch S, through a lamp resistance, $L_2$, to the pen arm P in the recorder. When the pen arm has moved over to the left, near the ink drum, it is brought into contact with the contact piece $C_1$, thereby energising the electromagnet $R_1$ in a relay which closes the secondary circuit on that relay, thus operating the motor $M_1$. This motor operates through

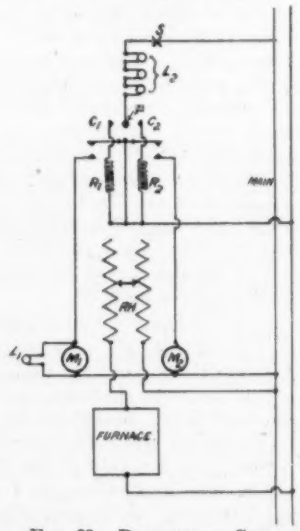


Fig. 23.—Diagram of Connections.

a worm and worm-wheel to increase the electrical resistance of the rheostat RH, thus reducing the current through the furnace. Alternatively, when the pen arm is free over the chart and is depressed thereon, if the temperature is below that determined by the template, the pen arm will make contact on the template itself and thus through the circuit $C_2$, and the relay $R_2$ will close the circuit of the motor $M_2$. This motor operates to decrease the electrical resistance of the rheostat RH, thus increasing the current through the furnace. This circuit through $R_2$ and $M_2$ is only completed when the temperature is below that determined by the template; the speed of the motor $M_1$ is made less than that of the motor $M_2$ by shunting $M_1$ with a lamp resistance $L_1$, so that, so long as the temperature is below that determined by the shape of the template, there is a constant balance of tendency to decrease the electrical resistance of the rheostat RH and thus to increase the current through the furnace. On the other hand, when the temperature has passed above the limits of the template (whatever its shape may be) there will be no contact made through $M_2$, but there will be a contact made through $M_1$, so that there will be a tendency then to increase the electrical resistance of the rheostat RH, and thus to decrease the current through the furnace.

The Cambridge & Paul Instrument Co., Ltd.—Among the large number of exhibits on this company's always interesting stand, several devices of particular interest were noted. A novel invention of proved utility is the remote power indicator, which has been patented by Mr. E. Fawssett, chief of the Research Department of the Newcastle-on-Tyne Electric Supply Co., Ltd., that gives a local indication of a.c. power at a distant station, which may be several miles away. For single-phase measurements the apparatus consists of a sensitive Cambridge unipivot indicator, a non-inductive resistance of suitable value, two current transformers, and two sets of thermo-junctions fitted with separate heaters. A potential transformer must be added in the case of high-pressure circuits.

Connections are made so that the e.m.f.'s of the junctions are in opposition. The heaters are adjusted so that, with equal currents through them, equal opposing e.m.f.'s are generated by the junctions. The current transformers, of equal ratios and similar characteristics, are connected one to each heater. It will be noted that the transformers operate separately from each other. The heaters are joined in series and are also in series with the non-inductive resistance. This series circuit, which is in shunt to the mains, corresponds to the ordinary moving-coil circuit of a wattmeter, the current transformer unit corresponding to the fixed coils. The connections from the current transformers are so arranged that at unity power factory the superposed currents in one heater are additive, and in the other are opposed. Now, if both heaters are at the same temperature, there will be no difference of e.m.f. between the thermo-couples and consequently no deflection on the indicator. If, therefore, the heaters are warmed by equal currents from the current transformers, or

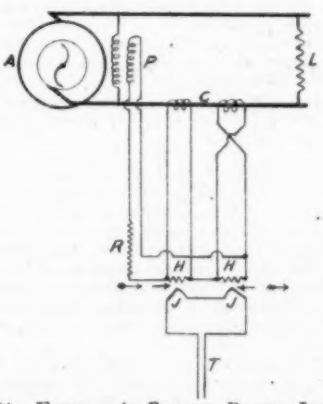


Fig. 24.—Fawssett's Remote Power Indicator.

the same current through the non-inductive resistance, there will be no deflection in either case. If, however, the heaters are warmed by currents from the two sources simultaneously, there will (except at a power factor=0) be a difference in the temperature of the heaters. Therefore, the e.m.f. from one thermo-couple will be larger than that from the other, and a deflection will be obtained on the indicator. It may be proved that the deflections of the indicator are strictly proportional to the watts of the circuit, *i.e.*, the instrument is a true wattmeter. By the provision of a condenser in the potential circuit instead of the non-inductive resistance, the apparatus is available as a wattless power indicator. The arrangements are also easily adaptable to polyphase circuits. The apparatus has been in efficient use for some time in connection with two stations nine miles apart, and should have a wide application for the measurement of power at a distance. The circuit diagram is shown in fig. 24, in which A (shown single phase for simplicity) is the alternator, P is the potential transformer, and L the load; C is the split-current transformer, and H the heaters combined with the thermo junctions J, while R is a resistance in the pressure circuit. The pilot cable T that connects the device to the indicator may be anything up to 20 miles in length; the arrows, with and without tail, indicate the flow of the potential and load currents respectively.

The string electrometer, originally suggested by Prof. Einthoven, is an instrument in which the moving system is a silvered quartz fibre tightly stretched between, and parallel to, two fixed metal plates. Not only is its capacity very small, but the motion of the fibre is dead beat and the period is short. The instrument is, therefore, a very suitable one for following and, if a suitable camera is used, for recording rapid changes in voltage in the study of discontinuous phenomena such as are met with in experiments in connection with the ionisation of gases. As regards sensitivity, the instrument compares well with gold-leaf electrometers; in fact, the minute force that is sufficient to deflect the silvered quartz fibre, *i.e.*, about $10^{-8}$ dynes, is of the same order of smallness as that acting on the gold leaf of the most sensitive of the usual gold-leaf electroscopes. The special feature of the model exhibited, fig. 25, is its compactness and the ease with which it can be assembled with any other apparatus. In particular, being flat, it may be used on a microscope stage without further fittings. The instrument consists of a silvered quartz fibre, each end of which is carried by a flag, which is anchored to an amber block by means of a brass clip. One flag is held in a slot in each clip by a screw; this makes the changing of the fibre extremely simple, as fibres can be supplied ready mounted on flags and can be transferred by means of a fibre manipulator.

The upper amber block is held in a fixed position, while the lower one is carried on a rocking arm controlled by a

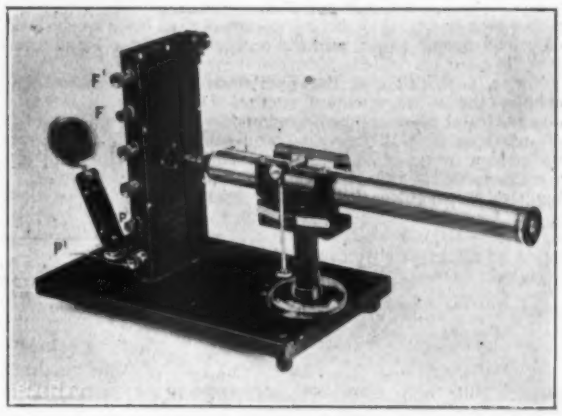


Fig. 25.—A String Electrometer.

micrometer screw at the right side of the flat case; to tighten the fire the head is turned clockwise or *vice versa*. The ends of the fibre are mounted on an invar steel rod, so that variations of temperature have only a small effect on the tension on the quartz fibre. Two parallel metal plates are held on either side of the fibre, 4 mm. apart, by ivory blocks. The position of the plates in relation to the fibre may be altered in a lateral direction by the screws P P', and they can be rotated, if necessary, to bring the plates parallel to the fibre. This lateral movement of the plates is important for ensuring that the fibre is situated in the electrical centre of the system, under which conditions the deflections of the

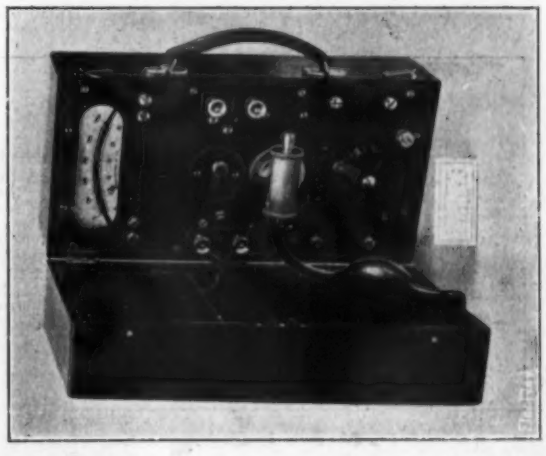

Fig. 26.—A Portable $CO_2$ and Temperature Indicator.

fibre will be equal in either direction. The terminal F' is connected to the fibre at its upper end, and the terminal F (connected to the case) is earthed.

The draught-proof brass case enclosing the system has windows back and front; through the former light is thrown on to the fibre by a mirror attached to the stand by a universal link, and through the latter observation of the fibre is made through a microscope, with a finely adjustable forward and lateral movement. For projection or photographic purposes the mirror and the link may be unscrewed and removed from the stand and an optical condenser fitted to the back window, to allow more concentrated lighting on the fibre by an arc lamp or "Pointolite" lamp.

Sensitivity and period, of course, vary with the optical work used, the tension on the fibre, and the potential difference on the plates. On one typical instrument with the standard optical work, 21 divisions for 1 volt was obtained with 87 volts on the plates, corresponding to a movement of the fibre of about 0.16 mm. for 1 volt. For this sensitiveness the

period was about 0.1 second. A much smaller period can be obtained by increasing the tension, but the sensitiveness is correspondingly reduced. The motion for practically all workable tensions is aperiodic.

The next illustration (fig. 26) shows the latest portable $CO_2$ and temperature indicator, which has been designed by the firm, and, as will be noted from the photograph, the instrument is quite self-contained. The catharometer and filter are inside the case, and it is only necessary to connect up from the flue and to connect the leads from the couple to the couple terminals; the gases are drawn up by squeezing the rubber bulb. The instrument is fitted with a switch with "test," "off," "$CO_2$," and "temperature" positions. The percentage of $CO_2$ is measured electrically, as has already been described in our pages, and the outfit is very easy to manipulate, is compact in size, and can be easily carried.

For a description of the firm's ray-track apparatus that enables the continuous emission of ionising particles to be observed and photographed, readers may be referred to p. 640 of our May 20th, 1921, issue, and other instruments shown included a new and lighter-pattern of "Omega" testing set, a compensated thermo-electric indicator (Rowcliffe patent), a temperature regulator (Apthorpe patent), a disappearing-filament pyrometer, Moll & Solomonson string galvanometers, a Kew-pattern dip circle and unifilar magnetometer, a Mackenzie Lewis polygraph for recording blood pressure in veins and arteries, two hydrogen ion outfits, one for accurate research work and the other for ordinary electro-metric titrations, and a multivibration galvanometer with 12 elements for acoustical work.

Messrs. Gambrell Brothers, Ltd., had on view a full range of resistances, potentiometers, standard cells, condensers, measuring instruments, wireless apparatus, &c. Prof. Waller's emotometer, an instrument for measuring a person's nervous response, was again shown this year together with a number of photographic records.

On the large stand of Messrs. Crompton & Co., Ltd., stroboscopic vibrators were again to be seen this year, and the other instruments shown included potentiometers, Wheatstone and Kelvin bridges, galvanometers, condensers, and several commercial instruments of the switchboard, watertight, and portable patterns. Many were arranged with open fronts in order that the latest types of movement might be seen, and the parts comprising them were also shown.

*(To be concluded.)*

# HARDENING AND TEMPERING STEEL STRIP.

## The "Lecfur" Electrical Process.

Based on the Imbery-Alexander patents, the Leeds Electrical Construction Co., Ltd., has recently built a duplex machine for electrically hardening and tempering steel strip, &c. The process is a continuous one, the strip being pulled through the machine, heated and quenched for hardening and tempering respectively, and then wound on to special section drums for the removal of the strip in a flat block. The heating process is carried out by passing alternating current at a low voltage through the travelling strip. The ohmic resistance of the strip, and the current flowing through it, produce the required temperatures for hardening and tempering respectively.

The plant is arranged to operate from a 500-volt, three-phase, 50-cycle supply obtained by means of a Scott-connected transformer, to give two-phase supply at low voltage on the secondary side. Suitable tappings are provided on the primary side of the transformer in order to obtain voltage regulation on the secondary side. Electrical control is provided, on separate switch panels, so that the temperature of the travelling strip can be adjusted within very fine limits. With the "Lecfur" plant any desired temperature may be obtained up to and exceeding the melting point of platinum. Electrical control is provided so that duplicate results can be obtained for every batch of strip.

The heating is carried out in a neutral atmosphere resulting in entire absence of scale and discoloration—in fact, the strip, after heat treatment, is as bright as previously. On the hardening end of the machine a "Lecfur" decalescence indicator is provided, so that the exact temperature for hardening can be obtained automatically and repeated day after day with certainty.

Fig. 1 shows a general arrangement of the machine for hardening two steel strips simultaneously, one side being capable of taking strip up to ¾ in. wide x .05 in. thick, the other side being suitable for strip from ¾ in. wide up to 1¼ in. wide x .05 in. thick. Fig. 1 illustrates the complete machine, excluding the electrical control gear. The strips are pulled through the machine by rollers driven through machine-cut gearing, and worm gearing, driven by a three-phase, slip-ring motor with rheostatic control for speed regulation. The plant is driven by separate motors, so that each side can be operated independently of the other.

The driving arrangements adopted enable the strip to be pulled through the machine at a constant speed. The transformer for operating the plant contains sufficient reactance to compensate for any slight variation in the voltage of the supply pressure. As the strip travels at a uniform velocity it is thus possible to obtain hardened and tempered strip of absolute uniformity, as every inch of the strip is subjected identically to the same heat treatment.

Fig. 2 is a close-up view of the tempering end of the machine. It will be observed that an air valve is provided so that air can be admitted to the heating chamber if desired, by simply opening this valve. This arrangement allows of an oxidising atmosphere in the heating chamber at the tempering end, and by adjusting the current input, any desired colour of temper can be obtained, if bright finish be not required. The steel strip, after being heated, is quenched between ground dies, so that any possibility of distortion during the quenching period is entirely obviated, resulting in dead flat hardened and tempered strip.

An important feature in connection with the plant is that if the strip be not uniformly rolled, the section necessarily changes, and therefore its resistance. This variation in section is instantly indicated on the electrical instruments provided, and the material, if faulty, can be returned for further treatment to the rolling department. Recording wattmeters can be provided with the machine so that the management has a permanent record of the heat treatment given to every batch of strip. The use of alternating current avoids the possibility of any electrolytic action, and permits of a more accurate control of temperature. The heating chambers are of rectangular section formed of phosphor bronze castings, lined internally with special refractory material to prevent loss by radiation.

The temperature of the oil in the quenching tanks is kept constant by circulation, obtained by pumps driven by chain gearing from the motor shaft. The strip, after being heated and quenched for hardening, is reheated and quenched for tempering. Electrical controls are provided so that the temperature for hardening and tempering is under separate electrical control, so that any desired hardness or temper can be readily obtained. The strip, after being hardened and tempered, is wound on to four-section winding drums, as illus-

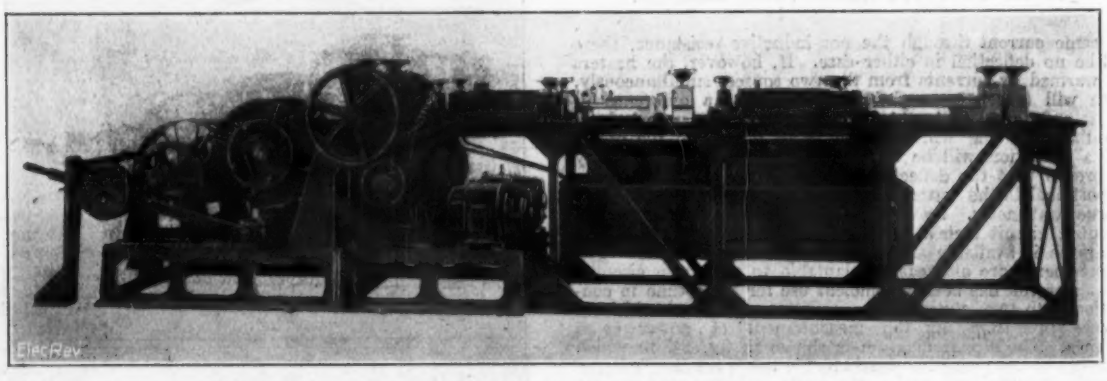


Fig. 1.—Electrical Hardening and Tempering Machine for Steel Strip.

trated in fig. 3. These sections are collapsible, so that the hardened and tempered steel strip can be readily removed from the machine. The four-section winding drum is driven by friction by a phosphor bronze pulley, fixed on a shaft driven by a belt from driving rolls. The friction drive takes up any slack on the strip, and the driving rolls ensure the constant

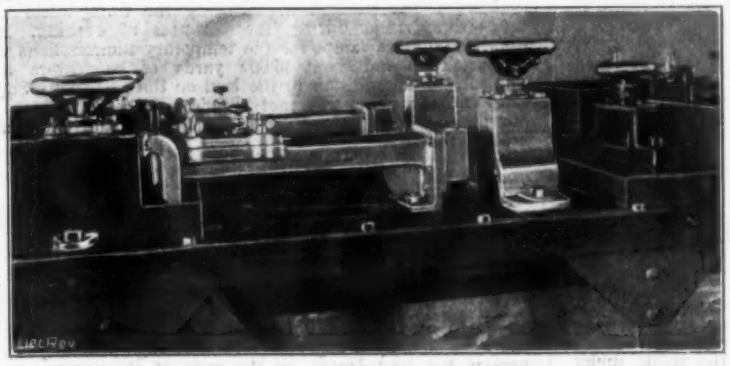

Fig. 2.—Close-up View of Tempering End of Machine.

speed of the strip through the machine. Fig. 4 illustrates an end view of the machine, showing the quenching tanks and electrical contacts, &c.

The plant operates at a high power factor (usually not less than 0.93), and can be constructed to operate from a single, two, or three-phase supply. When operating on polyphase supply, Scott-connected transformers are used so that balanced load can be obtained. The plant operates at low voltage, and can be operated by semi-skilled labour with the certainty of definite results. Due to the high thermal efficiency of the plant, the running cost has been found to be usually much less than with gas or combustion type furnaces. With electricity at 2d. per kWh, it is found with the "Lecfur" plant that the running cost for hardening and tempering steel strip is approximately one half the gas charges, with gas at 4s. per 1,000 cu. ft. In addition, as there are no excessive refractories to maintain, the cost for maintenance is usually much less than when combustion methods of heating are employed.

With the "Lecfur" plant, an improved quality of output can be obtained, as the temperature is under perfect control. A kWh of electricity will always give a definite heating value, whereas this cannot be obtained with gas or combustion methods of heating. With the latter, any variation in the calorific value of the gas supplied produces a variation in temperature, and whilst governors may be employed for regulating the pressure, it does not appear there is any commercial system available for regulating the calorific value of the gas. It is, therefore, impossible with combustion methods of heating to get the definite results which are obtained by electrical methods of heating. As there are no products of combustion to be dealt with, the "Lecfur" plant enables improved working conditions to be obtained.

In addition to plant for hardening and tempering steel strip, the Leeds Electrical Construction Co., Ltd., also manufactures complete electric plant for hardening and tempering steel wire,

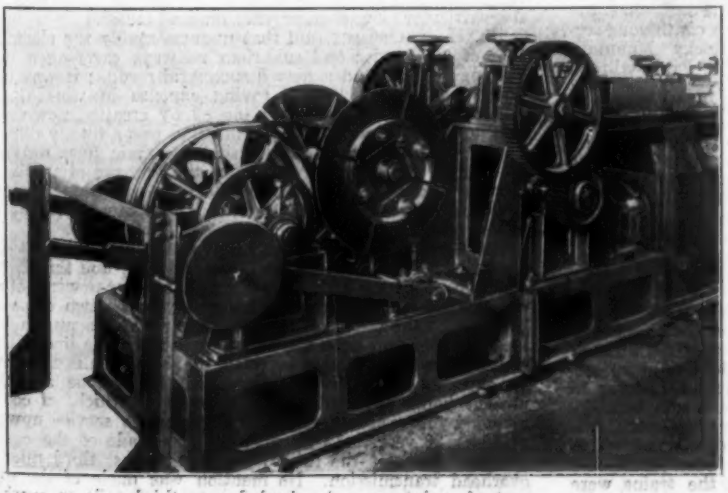

Fig. 3.—Winding Drum End of the Machine.

bright finish, for all gauges from 16 to 50 s.w.g. The wire plant operates on a similar principle to the strip plant, but the constructional details are somewhat different.

## ELECTRICAL NOTES FROM INDIA.

(From Our Special Correspondent.)

While a comprehensive scheme for the improvement of the water supply at Calcutta is in its preliminary stages, a distinct improvement has been recently effected at the Watgunge pumping station, near Hastings Bridge, which will do much to maintain an adequate supply of water (unfiltered) to the southern portions of the city. The engines at the Watgunge station were in use at Mullick's Ghat for 20 years, and were subsequently re-erected at Watgunge, where they have extended their lives to over 40 years in all. As they were thoroughly worn out and very inefficient, the Corporation decided, as a temporary measure for improving the supply, pending a decision regarding the whole water supply of the city, to install an electrically-driven centrifugal auxiliary pump. This pump is capable of supplying 3,500 gallons of water per minute against a head of 120 ft. This represents an improvement of about 75 per cent., and complaints from the southern quarter, which were formerly

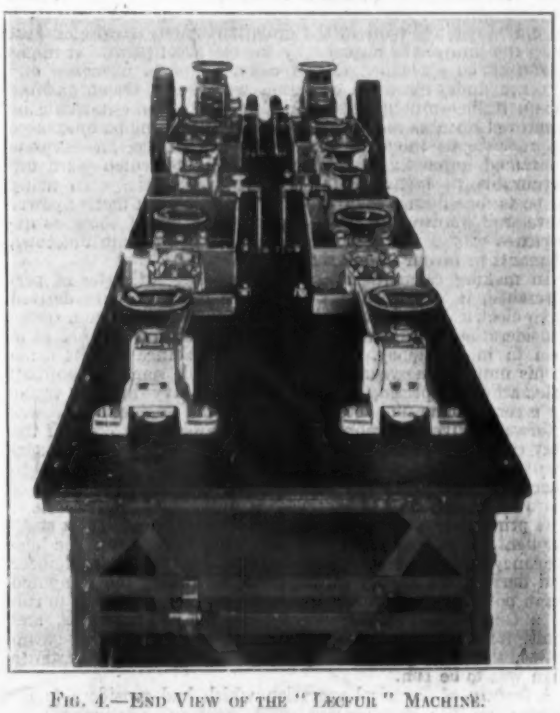

Fig. 4.—End View of the "Lecfur" Machine.

frequent, have now practically ceased. The pump has been in operation a few weeks only, and has proved so satisfactory that the question of duplicating it is being considered. In the event of another pump being installed the existing steam pumps will be scrapped.

There was a small but keen attendance at a recent meeting of the Bombay Association of the Institution of Engineers. There was an informal discussion as to the lines which should be taken for the development and advancement of the Association. It is earnestly desired to increase the membership, and it transpired from some remarks passed that the difficulty as regarded affiliated members was to obtain proposers and seconders owing to the comparatively small present membership. To remedy this defect it was proposed that the rule calling for proposers and seconders to applications for affiliated membership should be held in abeyance till next June.

It has also been proposed that papers of the old stereotyped form should be replaced by discussions, especially since the "Electricals" and "Mechanicals" at home had moved in this direction. The Indian Institution of Engineers itself has made steady progress since its inception two years ago, as may be judged by the fact that, despite the

rather high standard of professional qualification demanded of its members in their various classes, the membership has already reached the satisfactory total of 500.

H.E. the Governor in Council has granted a licence to the Ootacamund Municipality for the supply of electrical energy to the town of Ootacamund, the licence commencing from December 6th, 1921. The area of supply is contained within the Municipality of Ooty and the Lawrence Memorial School. The supply will be medium-pressure, a.c., 3-phase, 4-wire at 400 V between phases, and 230 V between one phase and neutral, at 50 cycles.

Surveying and plan drawing in connection with the Aberdeen-Laxapana hydro-electric scheme in Ceylon have progressed sufficiently to enable a fairly accurate estimate to be made of the cost of the work up to and including the generating station. The survey and location of the h.p. transmission lines has begun. The report of Mr. Bolton, who went to Ceylon for the consulting engineers, shows that cyanamide could be produced on the island at less than the price of the present imported article.

On the occasion of the visit of the Prince of Wales Calcutta almost rivalled Bombay in its illuminations. It was a fairy-land with the whole city lit up on the most scientific basis. The Victoria Memorial was the subject of a special lighting scheme, which resulted in throwing the huge white mass into striking relief during the darkness of evening. More than 90,000 extra lamps for the temporary illuminations were connected up and about 45,000 yards of conductors used. The substantial addition to the load on the Electricity Supply Corporation's plant was met without difficulty, though the distributors were somewhat overloaded in the illuminated area of the city.

## THE ELECTRIFICATION OF MAIN-LINE RAILWAYS.

(*Concluded from page 176.*)

Mr. F. W. Carter said that in making a comparison between steam and electrical operation of a given railway, it should not be forgotten that the methods of working the traffic under steam operation had grown up around the steam locomotive, and were subject to the limitations imposed by the steam locomotive. In like manner, the methods of electrical operation would inevitably tend in the direction which conformed best with the limitations imposed by the electrical plant. It might therefore be concluded that if estimates of performance and expense under electrical operation were based on an existing steam traffic—usually the only reasonable basis—it would be improved upon as methods of working the traffic became more appropriate to the new motive power. Thus, an estimate contained implicitly a number of features which were unfavourable to a change from existing methods. In many respects the differences involved in the change of motive power were well known; in other respects they would show as experience was gained, but there would always remain unknown elements in favour of existing methods.

In making calculations on which to base estimates of performance, it was necessary to ensure that the data derived from electrical considerations and the data derived from traffic considerations should not be combined in such a manner as to lead to inconsistency. An instructive instance of this came to his notice some years ago. He had made some preliminary calculations respecting the working of heavy mineral traffic on a certain line, on data supplied by the engineer. He was afterwards given the opportunity of examining a copy of the very careful and full report that had been made to the management on the subject, and was surprised to find that the engineer's estimate of energy consumption was much in excess of his own, which he had regarded as quite conservative. As it was principally a matter of lifting heavy trains against a steep gradient, a radical error was indicated. He found the discrepancy to be due principally to the fact that the engineer had derived the energy consumption by taking the computed mean power of the electric trains, which were intended to run at a considerably higher speed than the steam trains, and multiplying it by the observed running time of existing steam trains, thus in effect running a considerably greater distance than was to be run.

A feature of electrical operation which had considerable influence on the organisation of a railway, particularly as regarded locomotive divisions, arose from the fact that the electric locomotive was capable of much more continuous service than the steam locomotive. The Rocky Mountain divisions of the Chicago, Milwaukee, and St. Paul Railroad were, in steam days, he believed, three in number. Now, the electric locomotives took trains over the whole 440 miles without change. Moreover, when the 200-mile interval between the Rocky Mountain divisions and the Cascade division had been electrified, the trains would be taken through to the coast without change of locomotive, a total distance of about 850 miles. When English railways were electrified they might look forward to runs from Penzance to Aberdeen, for instance, with a single locomotive, but the organisation required to give effect to this would differ radically from that at present existing, and the difference would, in the main, make for saving in operating expense.

One consequence of the continuous service possible with electric locomotives and of the small amount of time consumed in overhauling, repairs, and inspection, was that the number of locomotives required to work a given traffic was much less than in steam operation. It was not unduly conservative to say that, in general, about half the number was sufficient.

Another direction in which the organisation of electric railways would tend to differ from that of steam railways was in the closer co-operation that was desirable between traffic and operating departments. On steam railways the trains were independent units, which, apart from limitations of track, did not affect one another. On electric railways, they were tied in groups to sub-stations, and through these to the generating station or stations. The amount of plant that must be held at the disposal of the railway in generating station and sub-stations depended on the maximum demand for power; but the work done by it depended on the average demand; and the greater the load factor, or the ratio of the average to the maximum, the more efficiently was the plant used. The economy of operation was therefore the greater the more uniformly the load could be distributed, both in time and in space.

The improvement of the load factor required that the traffic should be to some extent under the control of the operating departments. An interesting example was furnished by the Chicago, Milwaukee, and St. Paul Railroad. For the working of its Rocky Mountain divisions, it purchased energy from the Montana Power Co., which operated a number of hydro-electric plants in the vicinity. The hydro-electric station, even more than the steam power station, required a high load factor; for the running costs were insignificant, and almost all the cost of power was interest on capital outlay. Practically, therefore, it was determined, not by the average power, but by the maximum, or by the amount of plant that had to be held at the disposal of a customer. In the steam power station there was a large expense for fuel, which varied practically as the energy output; and the load factor was accordingly of somewhat smaller importance. The payment for energy in the case of the Chicago, Milwaukee, and St. Paul Railroad was made as follows:—If the load factor exceeded 60 per cent., the energy used was paid for at a flat rate of about a farthing per unit; if, however, it was below 60 per cent., the price per unit was increased in the ratio of the load factor to 60. It was, therefore, to the advantage of the railway company to keep the load factor as near 60 per cent. as possible. The load factor of an electric railway, in which the traffic was worked just as on a steam railway, would probably not exceed 25 per cent., and in the case where regeneration was a feature, probably not 20 per cent. By putting large powers in the hands of a train dispatcher, however, and by means of certain automatic devices which caused a drop of voltage when the current was excessive, the load factor was kept very near to the desired figure of 60 per cent., so that the railway practically paid in proportion to the energy actually used. It would probably be found hardly feasible to proceed quite to such lengths in the case of the British railways, but, as all steps in this direction made for economy, it was desirable that the traffic and operating departments should co-operate with the particular view of improving the load factor.

Mr. H. N. Gresley said that unquestionably the electrification of sub-service and suburban railways carrying a dense passenger traffic had achieved successful results; it was introduced not as a means of saving expense in working, but rather as a means of making money by creating new traffic. The problem of main-line electrification was a totally different matter. It could not be urged that the main lines were congested; on the contrary, at present the tonnage of traffic was considerably less than it was in 1913; a much greater tonnage could be carried with the existing equipment without any necessity for doubling the line.

The electrification of main lines was largely contingent upon the price at which energy could be obtained, and this in turn was dependent upon the erection of the super-power stations, of which so much had been heard a year or two ago. The question of the provision of super-power stations was in itself largely dependent upon the electrification of main lines. Comparisons had been made between the best results that could be expected from electrification, and the average results at present being obtained by steam traction, which, of course, included the results derived from engines in service upwards of 20 or 30 years. Little mention was made of the cost of the equipment of the lines with sub-stations, third rails, or overhead transmission. No mention was made of the extra cost of maintenance involved due to third rails or overhead wires, and in the former case the extra cost of maintenance of the running track due to the presence of the third rail.

Sir Philip Nash, in March last said that, broadly speaking, ing. electrification of main lines could only be expected to show

direct savings where traffic was very dense, and even in such cases the most favourable conditions were a network of lines covering a limited area, or a section of line where the volume of traffic was such that increased line capacity must be provided if steam haulage was to continue. The criticisms which he had made were unquestionably against the electrification of main lines, but he was strongly of opinion that the electrification of suburban railways and perhaps of heavy mineral railways should be undertaken as soon as the necessary money could be raised at a sufficiently low rate. No doubt the electrification of main lines would come eventually, and considerable advantage would be obtained in shunting by electricity.

Mr. J. A. Hookham said that the electrification of suburban lines had been of great advantage to the public by providing quicker and more frequent service. After detailing the advantages claimed for electrification, he said the following figures were given at a meeting of the Institution of Locomotive Engineers:—

Two lb. of coal in power station to produce 1 kWh; efficiency of transmission of power to drawbar 62 per cent.; giving 3.2 lb. of coal per kWh or 2.4 lb. per h.p.-hr. at drawbar. For the ordinary steam locomotives the figure varied from 4 lb. to 8 lb. per h.p.-hr. at drawbar.

An objection was raised against electrification that a whole section might be thrown out of use and the traffic stopped more completely than could happen with the independent units of steam traction. So far this had not proved a very real difficulty, and the danger of stoppage could be very greatly minimised by arranging for one section to be connected up with the next, and the offending sub-station to be cut out temporarily. Breakdown at a power station could be guarded against by duplication of plant—but at increased outlay. It had been assumed that the electrification of existing lines only was in question where the existence of a large capital, and the necessity for a further large capital outlay, severely handicapped the undertaking; where a new line was projected, the case for electrification was at present very strong.

As compared with the present-day locomotive, the position appeared to be that on main lines where the traffic was dense, and where, failing an increase in the speed to enable the line to carry more traffic, widening or doubling would probably have to be resorted to, electrification would be justified by the increase in speed it provided. The advantage of the elimination of turntables, coaling stages, and water troughs and columns, and the longer time an electric locomotive could keep at work without attention, were all points in its favour.

It was possible that further improvements in steam locomotives or, as seemed probable, the development of the internal-combustion engine, might alter the whole aspect of affairs before many years were past, and in this connection a combination of the semi-Diesel engine with electric transmission and the overhead wire or live rail linking up a number of such motors, as proposed by Captain Durtnall, would form a good intermediate step, and render possible the gradual electrification of a railway by the substitution of such motors for steam locomotives in the ordinary course of revenue renewals—thus avoiding the large capital outlay required for root-and-branch electrification.

The discussion was then thrown open, and Dr. F. C. Lea, as a civil engineer, drew attention to the effect of conversion from steam to electric traction on bridges. The locomotive engine could not be enlarged because of the limitations of the minimum structure gauge; boilers and cylinders had reached practically the maximum size possible. Further, the cross girders and main girders of all existing bridges compelled the railway civil engineer to limit the mechanical engineer not only as to the maximum axle loads on individual axles but also to a certain extent the total maximum loads that could be allowed on a given wheel base. A first-class passenger engine at the present time could hardly have more than 60 per cent. of the total weight of engine and tender on the main driving wheels, and the length of the rigid wheel-base would probably be of the order of 15 ft. The load on each axle would probably approximate to 20 tons. In an electric passenger locomotive having the same tractive force the load would be distributed on more axles, which was of great importance in relationship to cross girders and the rigid wheel-base on any bogey would probably be not greater than 8 ft. 6 in. The total length between the extreme driving axles would be very much greater in the case of the electric than the steam locomotive, and then the "equivalent load per foot run" which determined the bending moments on the main girders would be less for the electric than the steam locomotive. Further, more than 75 per cent. of the total weight of the locomotive would be on the driving wheels of the electric as compared with 60 per cent. or less of the weight of the steam locomotive and tender on its driving wheels. Another very important factor in this connection was the diminution in the loads on cross-girders particularly due to the unbalanced forces in steam locomotives. Rotating balance weights were introduced into the driving wheels to balance the reciprocating masses of the engine. The balance weights in the wheels were, except for the weight of part of the connecting rods at the crank pin, unbalanced in a vertical direction, and thus the loads on cross girders were considerably increased at high speeds beyond those of the axle loads. In the electric locomotive there was no necessity to have reciprocating matter and thus for the same tractive force the bending moments produced in bridge girders would be much less for the electric than the steam locomotive. This meant that although the steam locomotive had practically reached the limits of size and loading for existing structures and no developments were possible without almost prohibitive expenditure on bridges, very considerable increases in tractive force, and thus in the possibility, not only of heavier trains, but also of very much better mean speeds, could be obtained by the use of electric locomotives without increasing the strength of existing structures. The steam locomotive was also limited in size, and therefore in its steaming capacity, by the existing minimum structure gauge, while the electric locomotive could allow of very considerable increases in tractive force, keeping within the limiting gauge. Thus the civil engineer's demands for limitation of loads on existing structures could be easily met, while the train-drawing capacity could be very considerably increased by electrification of main lines. Many of the civil engineer's most serious problems of maintenance would also be very considerably diminished, particularly the rusting of steel structures, by the adoption of electric traction, while in stations and tunnels the comfort of the travelling public would be greatly increased and in the country loss of crops, &c., from fire would not occur. The more perfect automatic control of signals and of trains would be ensured, and serious railway accidents due to fog and the failure to observe signals (or even due to signalmen) ought to become unknown. Thus against the heavy capital expenditure necessary for the conversion to electric traction there would be many assets besides those arising from the very distinct economies in coal and men which, it was admitted, were possible. The cost of the dislocation of the railways on a day of serious fog was very great. With electrification the delay would not be anything like so serious, and large sums could be saved from this source alone.

Professor Burstall pointed out that quite recently a proposal had been made for the more efficient working of the main railway lines by the use of the Diesel motor for propulsion. This proposal was the combination of the direct drive of a Diesel motor with the use of compressed air for providing the starting torque. The proposal was as yet only on paper, but it struck him that, before this country embarked upon an enormous scheme of electrification of the main lines, it might be desirable to spend a small amount of money in investigating other sources of driving power. Technically, the proposal seemed to have much to commend it, and there was also an advantage on the economic side, for the Diesel motor must be cheaper in its costs than a complicated system of transmission.

Professor Champ drew attention to two points, one of which, he said, he regarded as of fundamental importance. Previous speakers had taken for granted that the traffic on the main lines would be similar under an electrification scheme to that which existed to-day. That, to his mind, was to start absolutely at the wrong end. When one took the dimensions of England, the distances between large towns, say, Birmingham and London, these became, after all, only suburban traffic distances when viewed from the standpoint of railway and geographical conditions in the United States. If the conditions which had been to the advantage of suburban traffic, when the suburban lines were electrified, could be applied to what they called "main lines" in this country, the result would be a great increase in travelling in England. He was perfectly certain, from a series of observations and records, which he had obtained from different people who travelled in various parts of the country, and who now either used private motor cars or went by big road vehicles, that there was an enormous demand for short trains of high acceleration and high frequency from places like Birmingham to London, Oxford to London, and so on. That, to his mind, was where the railway engineer should start in electrification if he wished to make the main lines of England a success. He should assume that the present system was wrong. The present long train was due to the steam locomotive, and if the railway engineer would start with all the advantages of electric traction, with shorter trains, high acceleration, and great frequency, he would make the thing a success from the outset. Having regard to foreign experience, some of them were dismayed at the decisions which had been arrived at by the Railway Commissioners with regard to their recommendations as to transmission and distribution of electric power. The 1,500-volt d.c. scheme might be a success, but this was not the time to lay down such a hard and fast regulation. They should have far more elasticity and discussion before they were limited in that way.

Mr. R. A. Chattock (electrical engineer to the City of Birmingham) said that from the point of view of the electric power station a railway load was a valuable one, because it had a high load factor. They were told that it should approach 60 per cent. The ordinary load factor at the power station was in the neighbourhood of 30 or 33 per cent., so that the railway load factor would improve the results obtained in the station. That would be a benefit not only to the industrial supply from the station, but also to the railway supply itself, because they were told that the railway could obtain energy from a power station at 0.6d. delivered to the track, with coal

at 30s. per ton. If the power station could be operated with a high-load factor he thought it should be able to supply energy at a lower figure than that quoted by Mr. Smith. Electrification which had taken place so far on suburban lines had, they were told, attracted an increased amount of traffic, and the only way in which it could attract additional traffic was by making the traffic cheaper or easier. It had done so on the suburban lines; why should not the same thing happen on the main-line railways? There the traffic should be attracted just as much as in the case of the suburban lines, and in addition the minerals or the goods traffic should also be attracted, with the result that it would improve the trade along the routes of the lines, and so increase the volume of business done by the railway companies. These points had not been sufficiently emphasised.

Dr. Gisbert Kapp said the point made by Dr. Lea was illustrated by Continental experience of a.c. electrical equipment of main-line railways. It was essential that they should allow for three-phase locomotives. The engines weighed 60 tons and developed 2,000 h.p. No steam locomotive could come anywhere near this. One line had been at work successfully for 20 years, and a similar system had been adopted by the Italian Government for the Mont Cenis line. It was significant that this system enabled a very great density of traffic to be hauled; for one thing, because it did not create smoke in the tunnel and so prevent visibility of signals; but apart from that there was the great tractive power which could be utilised and the fact that old bridges could be used without needing to be strengthened. This accounted for the enormous traffic which the line was able to carry during the war period, especially in 1917, when a lot of war material, and British and French troops, were transported into Italy. The traffic in mileage was trebled in comparison with pre-war conditions with steam. This system had been adopted by the Italian Government because the electric locomotives were comparatively light, and had, therefore, saved the expense of strengthening bridges, although their haulage power was very great. But it had two disadvantages. One was the power factor, in running on the cascade system. A good deal of idle current had been paid for. It was now in course of improvement by putting phase advancers on the locomotives. In Switzerland and Germany the single-phase a.c., system had been adopted. He was pleased to hear one speaker say that on the whole the overhead wire was preferable, for several reasons. The tendency seemed to be to use 1,500 volts direct current; modern dynamo-makers would be prepared to supply motors up to 600 and 800 h.p. per motor, which would work with 3,000 volts direct current, but 3,000 volts would not carry them any distance, unless they studded sub-stations along the line. It was no use going in for half measures in that way. They had been copying the Americans, but they should copy people who did better than the Americans. If they compared 3,000 volts on an overhead wire with 1,500 volts, they would find the wire need be only half the cross-sectional area; but the sub-stations could be ten times as far apart. For the direct current required, three-phase transmission was used. In the sub-stations they must have transformers, converters, and also a considerable staff, because they must work the system night and day. It would be a mistake to think that they could save labour by using automatic apparatus. They could save labour by using plant that would not require to be looked after, and that was what the Swiss were doing on the St. Gothard line.

In conclusion, he expressed the hope that whatever system was adopted, it would only be after very careful consideration, because once they had adopted a system they could not change it. Moreover, they should not contemplate the possibility that every railway should have its own different system. What they could make uniform was the main principle—low periodicity, high voltage, and single-phase.

A number of other gentlemen spoke, and the chairman said that he welcomed the pertinent points raised by Dr. Kapp. Professor Cramp suggested that they might, in particular, run smaller train units. He did not see much hope from that. On the heavy train to-day they had a driver, fireman and guard. They would have to have a driver and guard on the shortest trains. Labour entered into the running of trains just as into the running of power stations. Neither did he look upon the Diesel locomotive as a competitor with electrified main lines, save, perhaps in exceptional circumstances, with low density of traffic. There was no insuperable electrical or mechanical difficulty in the electrification of main lines, but there was a difficulty with regard to the financial side of the problem when they were dealing with a low density of traffic.

A vote of thanks to the chairman and the speakers concluded the meeting.

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**The Metric System in Canada.**—The Decimal Association informs us that a meeting of the American Metric Association, held in Toronto on December 29th, was well attended by a number of business men interested in the reform of weights and measures. It is reported that steps are being taken to form a local association, and that a committee has been appointed to carry out the preparatory work of organisation.

## THE PRODUCTION OF LIGHT, HEAT AND POWER.

On January 27th, Mr. A. Hugh Seabrook, M.I.E.E., addressed a meeting of the Junior Gas Association on the subject of "Gasworks and the Production of Light, Heat, and Power."

Mr. Seabrook prefaced his remarks by a condemnation of the engineer—gas or electrical—who refused to recognise the merits of the other side. He confessed to a leaning towards the unorthodox, being against dogmatism on particular lines. For 25 years his experience was electrical, but during the last few years he had been associated with gas engineers. As a result he had come to the conclusion that a closer association between the two branches was very desirable. It was not his intention to refer to the relative merits of gas and electricity; they were both primary public services of unlimited importance. A closer association of interests would result in gasworks, or, as he preferred to call them, "light and power stations," becoming as neutral as the coal merchant. The coal merchant supplied coal impartially to every industry without taking any particular interest in any one industry. In the same way he believed the only proper way to deal with the question of light and power was to aim merely at the most economical conversion of coal into light, heat, and power, in the form of gas or electricity, whichever the consumer found most useful for his purposes. Gasworks were found in the smallest towns, and the speaker thought that, as a rule, the engineers responsible for their construction had been happier in their choice than those who had settled the sites for electric power stations. Gasworks invariably had a railway siding and a plentiful supply of water. Electricity works too often had no railway siding, no natural water supply, and were frequently situated in residential districts. In planning the cheap production of light and power the cost and environment of the site were of the first importance. An important point, which was usually overlooked, was that the generation of electricity at a gasworks permitted of the use of coke as fuel, with a minimum of transportation cost. The avoidance of burning raw coal was eminently desirable, and of all the industries using coal the gas industry was, for all practical purposes, the only one that treated coal properly. Nevertheless, even the Government itself was actively encouraging the erection of large stations, wherein raw fuel was to be burned for the production of electricity. There was very little coal in this country which was too poor for special treatment, and Mr. Seabrook thought that an authority should be set up to prevent the direct burning of coal, which was rich from a by-product recovery point of view. The speaker noted the introduction of the "sandwich" system, employing coke and coal as boiler fuel, and regarded it as an important step in the direction of coal conservation. As an example of what might be done in the way of co-operation between gas and electricity, Mr. Seabrook instanced the proposals put forward by the Gas Light & Coke Co., and some of the London electricity supply companies. It was intended to supply electricity from a works at Beckton. Gas would be produced and the coke would be employed in the generation of electricity. The site was admirable in every respect and the arguments in favour of the scheme appeared to be irresistible. It was scarcely conceivable that electrical energy could not be produced more cheaply than at the recently-approved station lower down the Thames, which would consume enormous quantities of raw coal. The speaker was in entire agreement with Col. Woodall, who stated, in 1919, that the by-products of the gasworks were more than sufficient to keep the ordinary town electricity generating stations provided with fuel. The export of gasworks coke was on the increase; surely it would be better to use their coke and export their coal rather than to burn the coal and export coke. Mr. Seabrook believed himself to be the first to fit suitable automatic stokers to large station boilers (at St. Marylebone) for the purpose of burning coke breeze. Many difficulties had been overcome, but eventually coke breeze proved as efficient as coal, and reduced generating costs. He could not understand why the Beckton scheme had been rejected. He went on to say that in several instances where the possibility of combining the generation of gas and electricity was under consideration he had found that not only was there sufficient space for buildings, but there were existing buildings which could be adapted for generating stations. In the cases mentioned the electricity supply would not be larger than could be economically handled by coke gas producers and gas engines driving generators. Above a certain capacity coke-fired boilers and steam plant would have to be installed. The use of blue water-gas direct in the gas engines was contemplated, and there was reason to believe that this could be done satisfactorily.

The function of the engineer was to make the best possible use of what was available. It was a mere truism to say that they were not making the best use of their available material so far as the production of electricity was concerned, and Mr. Seabrook was convinced that this was largely due to the absence of co-operation between gas and electrical engineers. The public must rid itself of the megalomania which made it believe that anything colossal must necessarily be economical. They now had an Electricity Commission; there should be a Gas Commission on similar lines; this should be followed by amalgamation of the two as a Light, Heat, and Power Commission.

# NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

***Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.***

### Quick-make Switches.

A great deal of damage is done, and often breakdowns are caused, by bad contact in switches. Unskilled or careless operators will frequently put in a switch slowly and by degrees, so that when the switch is nearing the contacts violent arcing takes place. To guard against this harmful practice, the Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham, has introduced a range of switches possessing a quick "make" action as well as a quick "break." The quick actions at both make and break are effected by means of strong and unbreakable coil springs, which prevent the switch occupying any intermediate position. To make assurance doubly sure the action of the switching-in spring is followed up by the operation of the handle by the operator. Tests on these switches have proved that the quick action increases the effective life of the switch. There are two lines of these switches: the "Glasgow-Premier," fig. 1, and the "Paragon-Premier," fig. 2, named according to size.

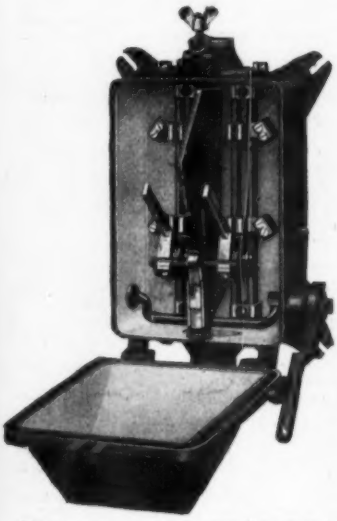

Fig. 1.—The "Glasgow-Premier" Switch.

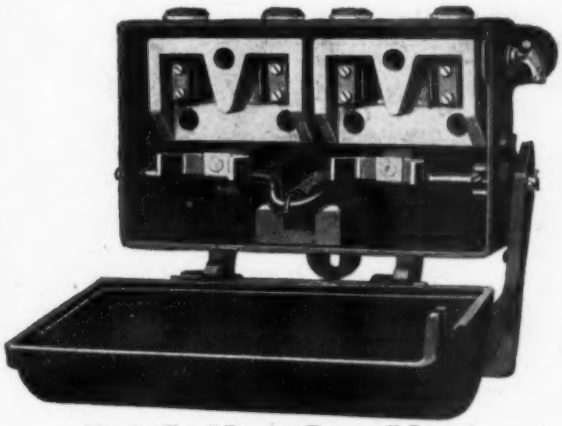

Fig. 2.—The "Paragon-Premier" Switch.

### Deep X-ray Therapy.

The demand for apparatus that will "stand up" under conditions of a continuous discharge through a tube of anything from 9 to 18 in. alternative spark gap maintained for several hours, or even all day, has involved considerable alterations in the design of both induction coils and transformers intended for deep therapy work. The new apparatus produced for this purpose by Messrs. Newton & Wright, Ltd., 471/473, Hornsey Road, N.19, is essentially a coil outfit, oil immersed, with the windings so arranged as to distribute, it is claimed, the strain equally throughout the whole of the secondary circuit. Immersion in an oil tank has been adopted as the most satisfactory method of insulation; any h.p. electrical discharge through air produces a deposit of nitric acid that rapidly destroys the insulation unless blown away, and has been the principal cause of breakdown in coils not originally built for therapy; the plan of excluding all air by immersion in oil appears to the makers to be the most reliable. The oil tank is hermetically sealed, and can be sent overseas if required without being emptied. The general design of the coil is very much modelled upon that of the firm's Snook machines—that is, it consists of two symmetrical coils mounted side by side, an arrangement that has been used in the present instrument purely for mechanical reasons. The interrupter is of the firm's usual "Instanta" pattern, but in view of the fact that continuous operation for many hours is required at a time, a filter has been devised which appears to effectually prevent any choking at the nipples. The break is provided with a h.p. rectifier, which is said to eliminate completely all inverse current, and means are provided to prevent the high-frequency surges which might otherwise be troublesome with plant of this type. The milliamperemeter is inserted in the secondary circuit at the zero potential, is incorporated in the switchboard, and is continually under the notice of the operator.

The whole apparatus is enclosed in a polished oak or mahogany cabinet, with a divided spark gap, &c., and all adjustments can be made from a control switchboard on wheels that can be moved to any part of the room. All the live parts are below the surface of the switchboard slate, and the control of the current is said to be extremely fine. As regards tubes, there are at present available a special Coolidge tube for this work, and also what is known as the "boiling water" tube; the latter is at the moment chiefly made on the Continent, but we understand that Messrs. Newton & Wright are to produce these tubes at their own factory in the near future. The firm has also introduced a Snook interrupter-less machine for deep therapy work that is oil insulated for very high pressures.

### The "Utility" Limiter-fuse Box.

In our issue of November 12th, 1920 (p. 618), we gave a description of the "Utility" current limiter. The makers, Electrical Utilities, Ltd., 1-3, Shelgate Road, S.W.11, inform us that they have now produced an apparatus combining the limiter with fuses. Fig. 3 shows the arrangement; the limiter is mounted on the lower portion of the base, while the connecting leads are taken from two H.O. fuses. All the necessary internal wiring is provided, and it merely remains for the wireman to connect the incoming leads to the fuse terminals and the service leads to the terminal block of the limiter. The set is suitable for use on a.c. or d.c. circuits up to 250 V.

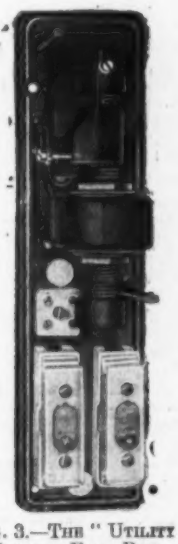

Fig. 3.—The "Utility" Limiter-Fuse Box.

### A Balanced-Vane Electroscope.

The *Bulletin* of the National Electric Light Association recently described an electroscope used by a member company of the Association. In the case of current-carrying conductors an exploring coil in conjunction with a telephone receiver is effective, but this method cannot be employed in cases where a conductor has a potential applied to it but no current is flowing. Gold-leaf electroscopes were used, but the delicacy of these and the difficulty of construction led to the devising of another form of electroscope. This instrument (fig. 4) consists of a suitable frame carrying an aluminium vane ¼ in. wide and 5¼ in. long pivoted at a point slightly above its centre of gravity and able to swing freely. The frame is mounted on a piece of hard rubber, and a brass cylinder fits over the whole to protect it. In use, the instrument is brought near to an exposed part of the cable insulation, when the existence of a potential is indicated by a movement of the vane towards the cable. This instrument works satisfactorily in all weather conditions, and in damp manholes where a gold-leaf electroscope would be useless. The most satisfactory results are obtained at pressures higher than 500 V. A polished rubber rod and a piece of silk go with the electroscope for testing purposes.

Fig. 4.—A Balanced-Vane Electroscope.

## NEW PATENTS APPLIED FOR, 1922.

**(NOT YET PUBLISHED.)**

**Compiled expressly for this journal by MESSRS. SEXTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.**

1,902. "Device for carrying and cleaning sparking plugs." A. J. Hobbins and A. E. Smith. January 23rd.
1,910. "Electric meter for measuring ampere hours." J. L. Gurney. January 23rd.
1,925. "Manufacture of insulators for aerial lines." G. Griffiths, W. Slack, and H. Wolfe. January 23rd.
1,936. "Aerials for wireless signalling on steamships." R. Tull. January 23rd.
1,938. "Systems of electric supply." H. Leitner. January 23rd.
1,972. "Indicator for vacant theatre seats." W. L. Guerin. January 23rd.
1,979. "Means for regulating telephone calls." G. C. Beall and G. C. N. Beall. January 23rd.
1,981. "Electric lamps for signalling, &c." Westinghouse Brake and Saxby Signal Co., Ltd. January 23rd. (United States, August 24th, 1921.)
1,988. "Electric gas-filled glow discharge devices for amplifying electric current variations, etc." Naamlooze Vennootschap Philips' Gloeilampen Fabrieken. January 23rd. (Holland, February 9th, 1921.)
2,003. "Submarine telegraph, &c., signalling apparatus." J. V. Foll. January 23rd.
2,008. "Train control systems." Automatic Telephone Manufacturing Co., Ltd., A. F. Bound, and A. E. Hudd. January 23rd.
2,020. "Telephone mouthpiece dust-proof cover." T. P. Howard. January 24th.
2,021. "Retarding devices of automatic circuit breakers." W. Frisby. January 24th.
2,035. "Electro-magnetic friction brakes." W. L. Spence. January 24th.
2,055. "Electric motor-controlling apparatus." C. C. Garrard and A. H. Railing. January 24th.
2,068. "Automatic guard for three-phase asynchronous motors, &c." A. Negle & Refardt and Negle Elektrizitats Ges. January 24th.
2,069. "Directly-acting magneto-electric driving mechanism for pumps." A. Negle & Refardt and Negle Elektrizitats Ges. January 24th.
2,077. "Bonding boxes, &c., for electric conductors." A. E. Read and Walsall Hardware Manufacturing Co., Ltd. January 24th.
2,081. "Tilter for electric lamps or shades." J. Wilson. January 24th.
2,087. "Grooved compound rails." F. Krupp Akt. Ges. January 24th. (Germany, February 9th, 1921.)
2,088. "Overload circuit breakers." F. Krupp Akt. Ges. January 24th. (Germany, February 19th, 1921.)
2,089. "Controlling devices for motors of electrically-driven vehicles." F. Krupp Akt. Ges. January 24th. (Germany, February 4th. 1921.)
2,097. "Means for electrically indicating presence of impurities in feed water." Babcock & Wilcox, Ltd., and A. R. W. Richardson. January 24th.
2,107. "Switchboards and bus bars therefor." W. Gee. January 24th.
2,122. "Pivoted moving-coil electrical measuring instruments." W. H. Apthorpe and Cambridge & Paul Instrument Co., Ltd. January 24th.
2,123. "Automatic starting of continuous or alternating-current motors." Compagnie Electro Mécanique. January 24th. (France, January 26th, 1921.)
2,125. "Vacuum or thermionic tubes or lamp bulbs." A. G. T. Cusins and J. H. Whittaker Swinton. January 24th.
2,145. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 24th. (United States, February 9th, 1921.)
2,149. "Thermionic valves, &c., for wireless telegraphy, &c." G. A. Irving & L. G. Preston and G. Shearing. January 24th.
2,150. "Thermionic vacuum tubes." L. G. Preston and B. Hodgson. January 24th.
2,151. "Thermionic valves, &c., for wireless telegraphy, &c." L. G. Preston and B. Hodgson. January 24th.
2,152. "Thermionic valves, &c., for wireless telegraphy, &c." L. G. Preston and B. Hodgson and H. G. Hughes. January 24th.
2,153. "Thermionic valve transmitting sets for wireless telegraphy, &c." L. G. Preston and G. Shearing. January 24th.
2,157. "Electric switchboards." P. J. Gates. January 25th.
2,158. "Mercury vapour apparatus, &c." T. F. Wall. January 25th.
2,162. "Manufacture of electro-plated goods." E. S. Jones. January 25th.
2,172. "Boxes for carrying electric lamps." A. H. Stevenson. January 25th.
2,180. "Wireless receiving apparatus, &c." Radio Communication Co., Ltd., and J. Scott Taggart. January 25th.
2,212. "Telephotography." D. von Mihaly. January 25th. (Hungary, February 18th, 1919.)
2,213. "Selenium, &c., cells." D. von Mihaly. January 25th. (Austria, December 9th, 1920.)
2,214. "Oscillographs." D. von Mihaly. January 25th. (Austria, December 9th, 1920.)
2,221. "Vacuum tubes." E. Y. Robinson. January 25th.
2,225. "Safety signal lighting system." J. Aarons and W. T. MacKay. January 25th.
2,235. "Electrically-driven sirens." J. Eaton and Efandem Co., Ltd. January 25th.
2,242. "Electric water heaters." Z. Trotzer. January 25th. (Hungary, November 24th, 1920.)
2,258. "Induction motors for alternating electric current." Crypto Electrical Co., Ltd., and H. G. Sharp. January 25th.
2,260. "Electric ship propulsion systems." L. H. A. Carr and Metropolitan-Vickers Electrical Co., Ltd. January 25th.
2,261. "Alternating-current electric motors." L. H. A. Carr and Metropoitan-Vickers Electrical Co., Ltd. January 25th.
2,262. "Electric ship propulsion systems." L. H. A. Carr and E. S. Jones and Metropolitan-Vickers Electrical Co., Ltd January 25th.
2,266. "Magneto electric lamps." A. E. Angold and A. H. Railing. January 25th.
2,267. "Electric lighters." A. Wirth. January 25th. (France, January 26th, 1921.)
2,277. "Automatic electric fuse switches." Bayerische Elektrizitats Industrie Rott & Co. January 25th. (Germany, January 25th, 1921.)
2,280. "Diaphragms for gramophone reproducers, telephone receivers, &c." E. A. Graham. January 25th.
2,281. "Electric treatment of liquids." H. J. Monson. January 25th.
2,287. "Method for producing metals or alloys poor in carbon and silicon in electric furnaces." Aktiebolaget Ferrolegeringar. January 25th. (Sweden, January 29th, 1921.)
2,294. "Recording and reproducing sounds." British Thomson-Houston Co., Ltd. January 25th. (United States, May 20th, 1921.)
2,295. "Magneto electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. January 25th.
2,351. "Extensible cable devices." Dictograph Products Corporation and E. W. Pattison. January 26th.
2,352. "Telephone transmitters." E. W. Pattison (Dictograph Products Corporation). January 26th.
2,355. "Electric connectors." H. F. Collins and G. H. Collins. January 26th.
2,360. "Sparking plugs." M. L. Parsons. January 26th.
2,370. "Appliances for registering telephone calls." A. Edgar. January 26th.
2,375. "Electrical cable attachments." Vulcan Motor & Engineering Co. (1906), Ltd., and C. B. Wardman. January 26th.
2,379. "Electric arc-welding systems operating with alternating currents." Quasi-Arc Co., Ltd., and A. P. Strohmenger. January 26th.
2,394. "Electric switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. January 26th.
2,395. "Electric relays." Metropolitan-Vickers Electrical Co., Ltd. January 26th. (United States, February 26th, 1921.)

## PUBLISHED SPECIFICATIONS.

**The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.**

### 1920.

17,976. "Ignition systems for internal-combustion engines." M. Polak. June 30th, 1920. (173,787.)
18,215. "Magneto-electric generators." Quick Action Ignition Co. February 17th, 1916. (146,294.)
19,376. "Thermionic-tube amplifying devices." M. Latour. July 7th, 1920. (173,793.)
19,763. "Multiplex telegraph and telephone systems." M. Latour. June 25th, 1915. (147,760.)
19,907. "Wireless telegraph receivers." Dr. O. Reichenheim. September 10th, 1915. (147,855.)
19,908. "Electric discharge tubes." W. Kossel. December 23rd, 1916. (147,856.)
19,934. "Dynamo-electric machines." Siemens-Schuckertwerke Ges. June 15th, 1918. (147,882.)
20,094. "Electric discharge tubes." W. Kossel. March 1st, 1917. (148,184.)
20,500. "Production of oscillations by high vacuum tubes having heated cathodes." Ges. Fur Drahtlose Telegraphie. April 30th, 1919. (148,525.)
20,831. "Circuit arrangements of automatic telephone exchanges." Ges. Fur Elektromechanische Telephonapparate. January 10th, 1914. (148,971.)
20,882. "Generator of electric oscillations, consisting of a thermionic tube in return coupling connection." Ges. Fur Drahtlose Telegraphie. August 7th, 1917. (148,991.)
20,960. "Thermionic valve amplifyers and generators." Dr. E. F. Huth Ges. and Dr. S. Loewe. July 4th, 1917. (149,213.)
20,965. "Thermionic receiving apparatus for wireless signalling." S. Loewe. April 18th, 1918. (149,218.)
21,094. "Electrically-driven talking-machine." A. Ebner. July 12th, 1920. (Convention date not granted.) (149,663.)
21,271. "Electric transformers." British Electric Transformer Co., Ltd., and J. Roothaan. July 14th, 1920. (173,800.)
23,200. "Sound-reproducing machines." L. K. Scotford. August 6th, 1920. (173,806.)
23,319. "Printing telegraph receivers." A. E. Alexander (Newsprinter Corporation). August 9th, 1920. (173,807.)
23,537. "Electric furnaces." L. W. Wild and E. P. Barfield. August 11th, 1920. (173,812.)
25,999. "Alkaline storage batteries." P. Gouin and E. Roesel. September 10th, 1919. (150,961.)
26,241. "Wireless telegraphy." S. Brydon and S. Johnson. September 13th, 1920. (173,832.)
27,805. "Means for securing machines, such as dynamo-electric lighting machines for cycles and the like." R. Bosch Akt. Ges. October 2nd, 1919. (151,935.)
28,077. "Manufacture of frames for polyphase dynamo-electric machinery." C. Ramoneda. February 10th, 1920. (158,865.)
28,198. "X-ray apparatus." British Thomson-Houston Co., Ltd. October 29th, 1913. (151,999.)
28,207. "Electric immersion heaters." F. Frei. October 5th, 1920. (173,848.)
28,395. "Electric heating devices." F. Maag. October 8th, 1919. (152,032.)
28,430. "Electric welding apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 7th, 1920. (173,859.)
28,559. "Electric heating and ventilating apparatus." Ventiheta (United Kingdom), Ltd., and P. J. Ogle. October 8th, 1920. (173,865.)
28,577. "Insulators for the suspension of high-potential electric lines." A. Richard. October 8th, 1920. (173,868.)
28,585. "Hand tools for electricians and the like." S. E. Aaron and A. P. Smith. October 8th, 1920. (173,869.)
28,603. "Electrical indicating apparatus for indicating the opening or closing of electrical contacts and the sequence in which the contacts were opened or closed." J. Simpson. October 9th, 1920. (173,873.)
28,613. "Radio interference preventers." H. G. Cordes. October 21st, 1919. (152,683.)
28,681. "Electrical contact-makers for use with the steering-wheels of motor-vehicles." J. L. Scott. October 9th, 1920. (Addition to 134,973.) (173,878.)
28,863. "Electric regulating systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 12th, 1920. (173,886.)
28,867. "Disposition of safety devices and connections in multiphase or polyphase generators and other electrical apparatus." K. R. Jhamuotila. October 12th, 1920. (173,889.)
28,986. "Electric fuses or cut-outs." O. Kominik and J. Nossig. March 10th, 1919. (152,352.)
29,076. "Sparking plugs." M. Pelizzola. October 14th, 1920. (Convention date not granted.) (152,358.)
29,407. "Thermally-actuated electric switches." P. W. Baker. October 18th, 1920. (173,905.)
30,133. "Control of electric circuits." Igranic Electric Co., Ltd., and C. W. Yerger. October 25th. 1920. (173,916.)
30,403. "Ignition systems." H. W. Eichbaum. October 27th, 1920. (173,920.)
30,599. "Means for interlocking electric switches." A. H. Railing, C. C. Garrard and W. Wilson. October 29th, 1920. (173,922.)
31,137. "Electric torches for medical purposes." J. Schmidt (A. R. Buckholtz & Co.). November 3rd, 1920. (173,933.)
31,224. "Incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). November 4th, 1920. (173,934.)
33,369. "Electric iron for domestic purposes." E. Bassett. November 26th, 1920. (173,948.)
33,796. "Systems for controlling electric motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 30th, 1920. (173,950.)
33,828. "Directional hydrophones." F. L. Hopwood. November 30th, 1920. (173,952.)
33,831. "Motor control." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). November 30th, 1920. (173,953.)
35,329. "Driving mechanism for hand-operated magneto-generators." A. H. Railing and A. E. Angold. December 15th, 1920. (173,959.)
36,131. "High-tension electric transformers." Veifa-Werke Vereinigte Electrotechnische Institute, Frankfurt-Aschaffenburg, and Dr. F. Dessauer. September 29th, 1915. (155,850.)
36,339. "Apparatus with electric arrangement for the generation of steam." F. Voegeli. July 18th, 1918. (156,099.)
36,599. "Manufacture of electric cables and apparatus therefor." Callender's Cable & Construction Co., Ltd., and J. F. Watson. December 31st, 1920. (173,969.)

### 1921.

2,113. "Resistance switches for controlling the intensity of electric currents." J. Watkinson. October 5th, 1920. (Cognate application 2,114/21.) (Divided application on 173,613.) (173,976.)
2,165. "Lighting gas by electricity." W. L. D. Gundry and Lord and Shand, Ltd. January 15th, 1921. (173,977.)
2,192. "Electric distribution systems." Dr. K. Koppensteiner. December 31st, 1919. (158,245.)
4,408. "Mercury vapour jet pumps with electric arc." Siemens & Halske Akt. Ges. April 24th, 1920. (Addition to 157,118.) (162,642.)
5,211. "Electric incandescent lamps." A. G. Mead and Mead & Jeffery, Ltd. February 15th, 1921. (173,986.)
5,523. "Steam turbines." K. Baumann and Metropolitan-Vickers Electrical Co., Ltd. February 17th, 1921. (173,989.)
11,026. "Means for the suspension of electric contact wires." L. N. Reddie (Consorzio per Elettrotrazione Co.). April 15th, 1921. (174,001.)
16,876. "Mercury vapour ejector pumps for high vacua." Akt. Ges. Brown, Boveri et Cie. June 24th, 1920. (165,400.)